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Secondary Rural Roads – Critical to Development But Sometimes "Neglected" : An introduction to this special issue of The Journal

Ian Johnston,
Chairman, REAAA Technical Committee

In October 1999, for the first time in its long and distinguished history, the World Road Association (PIARC) held its quadrennial World Roads Congress in South-east Asia. The Government of Malaysia was the proud host of the XXIst World Road Congress in Kuala Lumpur.

REAAA was given the honour of arranging and conducting a special workshop during the Congress to focus world attention on the role of roads in a nation's economic and social development, with special attention to this region. REAAA did so in close cooperation with the PIARC Committee responsible for promoting global technology transfer. We were delighted to have the opportunity as facilitating technology transfer in our region is a key objective of the REAAA Strategic Plan.

We chose to put the spotlight on secondary rural roads, because of a belief that funding levels for, and the technological study of, such roads do not match their importance in development. Judging by the excellent attendance at the workshop and the vigorous participation by the audience we met a clear need for debate. This issue of The Journal contains the four papers presented, together with a brief summary of the discussion that took place and of the conclusions reached.

I wish to acknowledge the support I received from my colleagues on the planning committee in turning an idea into reality:

- Dr Theo Michels, from the Centre for Research and Contract Standardisation in Civil and Traffic Engineering in The Netherlands;
- Professor Mohamed Rehan Karim, from the University of Malaya in Malaysia
- Professor John Metcalf, from Louisiana State University in the USA.

The success of this special event, however, was due principally to the speakers. We were extremely fortunate to find four people who not only had high expertise in the subject but who presented their material clearly and with passion. The Keynote Address, by Colin Ellis from the UK Department for International Development, provided an excellent overview of the issues. It was followed by three case studies – Malaysia (by Wong Wai Ching of the Department of Public Works), South Asia (by Thampil Pankaj of the World Bank) and Asia and Australasia (by Dick Wharton, formerly of Main Roads Queeensland). Both REAAA and PIARC are indebted to these four for the level of effort and expertise that resulted in a unique collection of papers on a relatively neglected topic.

KEYNOTE PAPER

The Role Of Secondary Rural Roads In Economic and Social Development In Developing Countries

C I Ellis
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1. Background

To clarify the scope of this keynote paper it may be helpful to define, at least loosely, what is to be considered as the meaning of 'secondary rural roads'. The term clearly does not include the routes which link significant urban centres but does include low volume roads which may be called collector roads and feeder roads. Many of these roads will carry traffic of less than 100 vehicles per day and in some countries may well have a surfacing of earth or gravel.

Although traffic levels may be low the total length of 'secondary rural roads' can often amount to 70% or more of the total national network. Circumstances will vary widely from country to country and from one climatic region to another but hopefully the principles underlying the comments in this paper will be valid for all.

It is probably fair to say that the current position, as perceived by the majority of people with a responsibility for this sub-sector, is that secondary rural roads are under valued and under funded. In times of extreme pressure on public funds, few would disagree with priority being given to the maintenance of primary inter-urban routes, but priorities need to be balanced to reflect the real importance of secondary rural roads.

2. Accessibility

The key role of secondary rural roads is to provide accessibility. A road has no value in itself. Its value lies in being part of a network which provides for peoples accessibility needs. Accessibility embraces both economic and social needs. Traditional approaches to the benefits of road investment concentrate on the economic benefits arising from increased outputs, the reduced costs of operating motorised vehicles and the beneficial effects on the prices of goods and services. (Economists refer to this as the consumer surplus approach). But this is only part of the story. There are other benefits that arise from access to markets and jobs, access to education and health services, access to credit and business support services and access to friends and relatives. Greater mobility can offer particular benefits through increased access to information and to the processes of government.

For heavily trafficked inter-urban roads, the traditional methodology demonstrates economic benefits that have been more than sufficient to justify the construction and maintenance of the primary network. The other benefits are more difficult to measure or quantify and therefore have been largely omitted from benefit calculations. However for secondary rural roads, the small number of motorised vehicles generate relatively small conventional economic benefits and hence social benefits need assessing if the true value of such roads is to be recognised by the policy and decision makers allocating the funds.

It is essential to recognise that a road is necessary, but not sufficient, to create accessibility and encourage development. In developed countries, schools, health centres, telephones, advice services and vehicles are relatively readily available even in rural areas. Thus road maintenance funding is enough to maintain accessibility. In developing countries the poverty in rural areas means that transport and other services are often not available and hence a road is not enough. When justifying rural secondary roads it is often mistakenly assumed that journeys only have value if they are productive eg transporting goods to market. In practice journeys often serve multiple purposes and transport services contribute to development by reducing peoples vulnerability to shocks and stresses and enabling them to build up their livelihood assets. These assets are normally referred to as the Human, Natural, Financial, Social and Physical Capital. The alleviation of poverty in rural areas can be closely linked to the development of these capital assets and secondary roads can make a vital contribution. Hence poverty and isolation in rural areas can only be alleviated if a sensible package of measures is provided.

3. Funding

The provision of adequate funds is a problem at both national and local level. At national government level, the issue is mainly one of achieving a logical, sensible and defensible distribution of funds between the various levels of the network. (In this context it is important to realise that the whole network starts at the bottom with paths and tracks). This can only be done if there is a common understanding and acceptance of the relative merits of economic and social benefits. It is interesting to note that at the last World Road Congress in 1995, Raymond Jhala, Chairman of the National Roads Board of Zambia explained that Government policy allocated maintenance funds in the proportions 40% for Main/Trunk roads, 20% for Council roads and 40% for District Council/Feeder roads.

In many countries national government only directly controls expenditure on the primary road system, with local government taking responsibility for road decisions for the secondary network. Unfortunately, the skills necessary to make these decisions effectively are often less readily available in local government than at national government level. Methods for influencing decision makers by logical argument are discussed below, but governments at all levels also need to be motivated by promises of money, power and votes. There is growing evidence of local governments using toll collection on district roads to finance their maintenance.

Once the broad allocation of funds between sub-sectors is established, it is important to ensure that there is a rational process of prioritisation for the use of limited funds.

It was emphasised above that a road only has value when it is considered as part of the overall road network. Unfortunately, the practice of 'project funding' still pursued by many donors and governments, has often contributed to serious misallocation of resources. For instance, we have probably seen examples of very high standard feeder roads leading onto important primary or collector roads that are in a complete state of disrepair. More recently we have seen attempts to overcome such problems by the emergence of funding mechanisms such as Sector Investment Programmes and Comprehensive Development Frameworks. This process avoids the risk of over investing in one project at the expense of deterioration of the essential associated infrastructure.

4. Decision Making

It is of course only realistic to accept that there will never be sufficient funds to do everything that is desirable. Therefore, it is absolutely essential to have a rational system for prioritising investment decisions. One way to ensure that investment decisions are taken in the interests of the network is to judge performance in terms of value of network assets. This should prevent investments in new 'pet' projects at the expense of the maintenance of the system as a whole.

If the true value of secondary rural roads is to be incorporated into a rational prioritisation system then that system cannot rely on traditional economic analysis but must take account of other non motorised traffic (ie pedestrians, animal carts, bicycles etc) and also value social and other benefits. The key question is: How can this be done?

The new improved HDM4 Highway Development and Management system, launched and promoted at the XXIst World Road Congress, recognises the problem and goes some way to providing a solution. For the first time in such systems, the modelling of the national vehicle fleet makes provision for the inclusion of animal carts, bicycles and pedestrians. Traditional measurements of ADT (adjusted daily traffic) only counted conventional motorised vehicles and ignored non-motorised means of transport (and also some of the locally improvised motorised vehicles). In practice the amount of freight carried by these can easily exceed that carried on conventional vehicles in the areas served by secondary rural roads. The new software not only recognises the benefits created by including non-motorised vehicles as part of the vehicle fleet but also assesses their impact on the flow of conventional motorised vehicles.

Other benefits are not specifically modelled in the new HDM4, but there is a provision for these externally calculated benefits to be included in the analysis and hence in the prioritisation of investments. The new software also permits the consideration of priorities across the network. Hence it can be used effectively for the analysis of changes in policy and strategy, and thus to inform the decision which controls the distribution of funds between primary and secondary roads, and between geographical regions. At the project or programme level, HDM4 requires large data inputs (although default values are always available and are appropriate for analysis at the strategy level). An important challenge for those responsible for secondary roads will be to develop ways of using HDM4 effectively, without allowing the data input requirements to become disproportionate.

There has also been other recent work on the calculation of benefits from low volume roads totally separate from the HDM4 software. Adaptations have been made of the 'Economic Index' or 'Priority Index' method used for prioritising road maintenance investments in Tanzania. This permits priorities to be based on the volume of traffic, both motorised and non-motorised, and look at the impact of maintenance

interventions in relation to the change in seasonal trafficability and change in road condition. Accessibility benefits can be taken into consideration by the use of weightings to the volume of traffic based on listed criteria (eg if a road provides access to a local hospital then an additional weight of 5% is added to the traffic volume).

This methodology has demonstrated that an improvement in trafficability (difference between wet season and dry season traffic flows) gives greater benefits than improvement to surface condition.

Similarly it is expected that improvements which induce a change of mode of transport (eg bicycle to tractor and trailer) will have a much larger impact than an improvement which induces a reduction of vehicle operating costs within the same mode by improving road surfaces. The use of subjective weightings to convert 'social' benefits into 'quantitative economic' benefits is a powerful tool if used responsibly and may be adapted for use with either of the methods discussed above.

5. Quality Standards - Sustainability

For the foreseeable future, the funding restraints mentioned above are likely to mean that developing countries will not have sufficient resources to provide well maintained rural networks at the quality standards currently expected. Priority must be given to investments which maximise the overall network benefits. This will show that the priority needs for rural transport services are greater availability and reduced cost.

In this context, most low volume roads are either designed and maintained to unnecessarily high standards or not maintained at all. The key issue is not road surface quality on individual roads but all-weather trafficability over the whole network.

6. Organisations and Institutions

If there is to be a change in the way that decisions are made in relation to secondary rural roads it is hoped that the sponsors of this session ie World Road Association (PIARC) and the Road Engineering Association of Asia and Australasia (REAAA) will influence their members to effect the necessary changes to the organisations with which they work.

At government level, there may be a need for organisations involved with secondary rural roads to be separate from the primary road organisations and take on a much wider development role which recognises the inter-sectoral nature of accessibility for development. Rural road planning and investment needs to be closely linked with the provision of transport and communications services and the locations of schools, hospitals and service centres. Organisations need to study how inter-connectivity promotes transport demand, how the private sector can be encouraged to provide transport services, how agricultural vehicles can be used to provide transport services, and how financial credit services are necessary to encourage local enterprise.

Private sector and civil society organisations also need to be involved in partnerships with local government if the problems of accessibility are to be tackled. Transaid Worldwide is an example of a new charitable NGO working to promote the integration of transport into all aspects of development work.

There are substantial development benefits to the areas served by rural roads, if the local communities are the main beneficiaries from any job creation or income generation arising from the construction and maintenance of roads and the provision of goods and transport services. There is little rural development benefit if all road maintenance and construction is carried out by large contractors using labour from the cities.

Transport programmes should not be permitted to focus on the needs of one stakeholder group above all others. They should be designed in such a way that vulnerable groups have equal access to the improved transport facilities. Communities and stakeholders must be made aware of the cost of alternative strategies and the need to make informed choices. For example, a surfaced road may be preferred until it is made clear that an improved track with intermediate forms of transport could be provided more cheaply and leave money available to meet other objectives.

Feelings of ownership are the most important factor in motivating users to take responsibility for the maintenance of transport infrastructure. Where a road passes through a village and is used by multiple communities, no one community may feel ownership of the road. Responsibility should be with an organisation at the lowest level of the hierarchy which still has the power to implement its policy.

A substantial effort is therefore needed to involve the local communities and to encourage them to participate in the decisions about road construction and maintenance. Labour and tractor based construction methods, where appropriate, will provide business opportunities for the local communities and add additional benefits to those arising from the road itself.

Ultimately an effective secondary road network is dependent on having effective local government institutions with the capacity to recognise the inter-sectoral nature of the development challenge and the role of secondary roads in that development. International donors are increasingly involved in

this type of institutional capacity building, but PIARC and REAAA can also play an important part. Both institutions need to actively expand their membership to include a wider range of other disciplines. Politicians, administrators, sociologists, economists, accountants, environmentalists, etc all have a contribution to make and particularly in relation to secondary roads.

7. Good practice in Asia

The picture is not all bleak. Most countries in Asia (and elsewhere) are already starting to tackle many of these problems.

The Philippines has provided a good example of incorporating accessibility benefits into the planning process for the development of rural infrastructure by the active involvement of local communities. Support has been provided by ILO and the Dutch government.

Laos is also doing a great deal on rural accessibility planning through links with UNDP.

In Nepal, the Department of Roads has developed Bioengineering techniques which minimise road maintenance costs in difficult unstable terrain and maximise the use of local skills in land and forestry management. These techniques are being incorporating in design standards and increasingly their benefits are being realised for reducing the cost of maintaining basic elements of the roadway such as shoulders and side drains, even in less extreme terrain. Nepal is also a pioneer in the development of toll collection on secondary roads to finance the costs of local maintenance. District Development Committees, Village Development Committees and Local Road Coordination Committees are permitted to raise funds for maintenance by collecting tolls at barriers across the road.

China has started to include secondary rural roads as an integral part of its primary road system projects using Asian Development Bank funding to ensure that connectivity benefits are made available to the poorer people in the rural areas served by the project.

8. Possible ACTIONS for REAAA and PIARC

The World Congress is primarily about making plans for the future. I recommend that REAAA and PIARC encourage their institutions as follows:-

a) Persuade governments, both national and local, that investment priorities should be based on consideration of all benefits from the network as a whole and not just the traditional economic benefits from individual roads. Traffic volumes should include motorised and non-motorised vehicles.

b) Encourage local governments and local communities to accept ownership of secondary rural roads and to provide local skills for road maintenance.

c) Persuade secondary roads organisations to work more closely with other 'rural development' departments to promote accessibility.

d) Encourage secondary roads organisations to consider reducing their design and maintenance standards on low volume roads where it can be demonstrated that overall network benefits can be increased by alternative use of investment funds. This means concentrating on good drainage, effective use of local or marginal materials, spot improvements and greater use of single track roads with passing places.

e) Actively promote and support current research on quantifying and measuring social benefits and incorporating them into the investment decision making process. Promote trials of HDM4 and its application to secondary rural networks.

f) Encourage the private sector and civil society organisations to enter into full partnerships with local communities to share the costs and benefits of accessibility.

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Rural Roads and Development in Asia and Australasia Australian Case Studies

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1. Introduction

1.1 Australia

The Australian continent stretches across three time zones, from the Indian Ocean in the West to the Pacific Ocean in the East. It is similar in size to the continental United States and, at its widest point, is about the same distance, east to west, as Madrid to Moscow. By way of comparison, the United Kingdom, with a population three times Australia's 19 million, would fit within its borders 32 times, while Malaysia, with a similar population to Australia's, would fit 23 times.

Australia is sparsely populated with less than 2.5 persons per square kilometre. Furthermore, the bulk of the population are concentrated in a few key areas along its coastline. Contrary to its image as a land of farmers and miners, Australia is one of the most urbanised societies in the world, with 85% of the population living in urban areas.

Australia has three levels of government - the Federal Government based in Canberra, six State and two Territory Governments, and 933 local governments. Each level of government has a role to play in the funding and management of the road network.

1.2 Road Network

The roads' sector in Australia accounts for up to 20% of GDP, and the current annual costs of operating our national trucking fleet amount to some A$12 billion per annum. Not surprisingly, Australia maintains one of the most extensive road networks in the world. This 800,000 km network is clearly one of extremes - it includes freeways and other high volume arterial facilities which are comparable to the best in the world, as well as many thousands of kilometres of unsealed roads (only 37% of the network is sealed) and rough bush tracks. The value of the network has been estimated at over A$100 billion.

[1] *The author acknowledges the assistance in the preparation of this paper of the Director-General of Main Roads, Queensland and his officers; and the staff of Ove Arup and Partners.*

Roads are classified according to a hierarchical and functional basis:

- The primary national roads - National Highways (NH)
- Urban roads - Urban Arterials (UA) and Urban Locals (UL)
- Rural roads - Rural Arterials (RA) and Rural Locals (RL)
- Private roads - Privately controlled Motorways, mining access roads etc.

Table 1
Australian Road Hierarchy

Category	Length (%)	Travel (%)
NH	2.0	13
UA	1.5	39
UL	9.5	20
RA	12.0	24
RL	75.0	4

As can be seen in **Table 1** above, although urban roads make up only 11% of the total network, the majority of travel takes place on the urban network. At the other extreme, rural local roads occupy 75% of the network, yet carry only 4% of total traffic. Where reference is made in this paper to secondary roads, in most cases these will be rural locals (RL), with some of the lesser rural arterials (RA) which largely act as feeder or collector roads.

2. Roads Management and Funding

2.1 Ownership

Overall "ownership" and management of the road network in Australia largely vests with State and local governments, with just a few roads under private ownership. Ownership proportions vary from State to State but, as an example, in Queensland, 34,000 km are controlled by the State government and 140,000 km by 125 local governments and a number of indigenous Community Councils.

2.2 Funding

Strategic planning and funding of the Australian road network is the responsibility of all three levels of government. The Federal government is a major contributor to road funding, particularly with regard to the National Highway network, where the bulk of funding for road construction and maintenance, together with establishment of expenditure priorities, is provided on a national basis.

The Federal government also provides substantial support for other roads through specific and untied grants to States and local governments as shown in **Table 2** below.

Table 2
Federal Government Road Funds Distribution 1999-2000

Funding Category	A$ million
National Highways	635
Grants to States	581
Grants to local governments	388
Total	**1,604**

The remainder of the Rural and Urban Arterial road network is mostly funded by the States and some of the larger local governments. Responsibility for most of the secondary road (Rural and Urban Local Road) network largely falls to local governments with a range of funding support from the Federal and State governments.

The proportion of road funding provided by each level of government varies from year to year. Typically, the States contribute 50% of total road funding and Federal and local governments approximately 25% each. Local roads typically account for 40% - 45% of total road outlays of which almost 60% is directed to maintenance of the network.

2.3 Vehicle Regulation

In Australia, traffic regulations and limits of vehicle dimensions, loading etc. are the responsibility of the States. Registration of vehicles and collection of registration charges are carried out by the States under similar, but separate, individual State regulations. Over recent years, States have sought to achieve national uniformity of road regulations with full implementation of uniform road rules and regulations expected in the year 2000. Much of the impetus for this move has come from the trend towards increased interstate traffic and the use of larger, more efficient, innovative freight vehicle combinations. This trend has seen the widespread introduction of B-Doubles with Gross Vehicle Mass (GVM) up to 62.5 tonnes, triple trailer road trains, and six trailer Double B-Triple combinations with GVM up to 170 tonnes.

While Australian communities have, by and large, accepted the use of these vehicles on the rural road network, there are, of course, restrictions on their use on urban roads, and individual local governments are able to restrict their use to specific secondary roads. Nonetheless, the promise of significantly lower transport costs through the use of these larger vehicles has bought new pressures on State and local governments to upgrade secondary roads to appropriate standards (particularly in closely settled farming areas) in order to be able to safely utilise multi-trailer combination vehicles.

Cattle Carrying Triple Road Train

2.4 Axle Loads

Control of axle loads and gross vehicle masses are critical components of any arterial road asset management system. They are of even greater importance in the preservation of secondary road assets. In Australia, enforcement of vehicle axle loading regulations is almost wholly the responsibility of State governments. Resource limitations mean that the majority of enforcement effort is currently directed to the arterial road system, however, it is likely that increased attention will need to be given to secondary roads in the immediate future.

For any flexible pavement, total axle loading in excess of the design load assumptions will result in reduced pavement life and require accelerated rehabilitation processes. However, for the thinner pavements commonly used on secondary roads, the damage caused by general over-loading is likely to be more marked. Also, under gross overload, thinner pavements may well fail totally through excessive rutting and shoving under trafficking by a single vehicle. For example, a single vehicle, with tandem and tri-axle loading (later measured at twice the legal limit), caused rutting up to 250 mm in depth over a length of 95 km on a sealed Beef Road in North West Queensland at the end of a wet season. The rehabilitation costs for this single event were many times the annual rehabilitation budget for this road.

The incidence of vehicle over-loading in Australia has been increasing. Data from a sample of 320,000 heavy vehicles detected at weigh-in-motion sites spread

over six rural districts shows marked increases in illegal loading in recent years.

Table 3 shows the increase in over-loading between 1995-96 and 1997-98.

Table 3
Over-loading trends

% Over-load	1995-96	1997-98	% increase
0 - 20%	28,000	37,100	32%
20 - 60%	1,400	4,450	315%
> 60%	13	176	1,354%

In the more remote districts, the data indicates that remote area illegal loads are far higher than those experienced in the more dense rural regions closer to the coast. Furthermore, the proportion of over loaded vehicles is two to three times greater. The introduction of effective self-management schemes, very much higher over-loading penalties (including possible vehicle confiscation) and an increase in the number of mobile weighing inspection teams will hopefully reverse these unsatisfactory trends.

2.5 Network Management Systems

A wide range of systems are used to record inventory and condition data througbout the Australian road network. The systems employed by the State Road Authorities are fairly sophisticated, a typical example being the Queensland Department of Main Roads' Road Management Information System or ARMIS. This system was designed in-house as an integrated system for holding, networking, analysing and presenting data on the State-controlled Road network to meet both corporate and regional field office requirements. ARMIS comprises a number of fully integrated sub-systems. The " hub" sub-system defines, classifies and describes the State road network as it currently exists, as well as providing historical information. Other sub-systems maintain information on structures, traffic volumes and composition, traffic speeds, vehicle masses and axle loads, pavement condition, road crashes and road maintenance costs.

All local governments also maintain road information management systems, however, these vary in complexity and functionality. At the very basic level, the systems provide information for each road regarding length, surface type (sealed, gravel, formed) and condition. Maintenance of such basic systems is required to provide data for calculation of eligibility for Federal Government road grants and is important for internal planning and budgeting. The more progressive local governments use computerised systems which not only provide inventory data but also provide the necessary platform for secondary road pavement management systems.

2.6 Forward Programming

All State Road Authorities and most local governments have strategic plans in place to guide the planning, management, development, maintenance and operation of their road networks. Generally, these have 10-20 year timeframes, with more detailed five-year programs, which include individual project details, and which, in turn, lead to budget approved annual works programs.

While almost all of these longer term strategies have a sound basis in economic terms and in terms of meeting expressed community needs, they are rarely constrained by likely future budget limits and, hence, tend to be optimistic. On one hand, this provides an incentive to ensure project planning and design is completed by the time funds do become available, however, it can create unreasonable expectations about the timing of new capital works. Nonetheless, such a strategic approach is vital to ensure proper development of secondary road networks, particularly where secondary road development can be shown to have greater overall community benefits than higher profile single large projects on the higher level arterial roads.

3. Special Rural Road Programs

3.1 Development of Special Programs

In addition to the normal funding arrangements for secondary roads as detailed in section 2.2, a number of "special" funding programs have been instituted from time to time to address particular secondary road problems or opportunities generated by particular industries or by political pressure. In time, some of the programs faded into obscurity for lack of continuity of funding, while others, because of the obvious wider community benefits and consequent strong political support, have become embedded in normal annual road funding programs.

A number of these programs have provided funding for works on all categories of roads, while others are restricted to particular sub-sets of rural secondary roads. However, all have provided significant benefits in rural areas as outlined in the following examples. These programs have extended over many years and, for ease of comparison, all expenditures have been converted to 1999-2000 values and are expressed in Australian dollars.

3.2 The Beef Roads Program

To assist in the development of the Australian Beef industry, particularly in the expansion of beef exports, in 1960, a joint Federal/State program was announced for construction of Beef Cattle Roads. These roads were to be provided to enable cattle to be transported to rail heads by road trains instead of by droving, thus enabling cattle to be turned off from properties at a much earlier

age and to be delivered to the rail heads and markets in a much improved condition. The roads were to be constructed to a sufficiently high standard of horizontal and vertical alignment to enable road trains to operate at legal speed limits (90-100 km/hr) over long distances.

The categories of road on which Beef Roads funds could be spent included rural arterials, developmental and secondary roads, however, all were characterised by extremely low traffic volumes. The standards adopted for these roads were quite modest with a flood immunity equating to 12 hours submergence in an annual flood, single lane bridges where bridging was required and relatively narrow formations. Many of these roads were not bitumen sealed initially, however, rapid deterioration of gravel pavements under the dry conditions experienced in the Australian outback caused a re-evaluation of this standard, and subsequent projects provided for a minimum 3.7 metre chip-sealed pavement with gravel shoulders. In most cases, paving and shoulder materials were sourced from naturally occurring ridge gravels or other alluvial sources.

The Beef Roads program continued until 1977 by which time most of the original program goals had been met and the road network of the outback greatly improved, particularly in the major beef cattle growing regions. Total expenditure on the program was A$780 million over 15 years.

The benefits to the cattle industry arising from the Beef Roads program were quite remarkable. Not only were the initial program goals well and truly met, but significant secondary benefits also accrued to the cattle and other rural industries. The ability to transport cattle and sheep long distances, quickly, enabled farmers to move their livestock to good pasture at relatively low cost in times of drought, thus, greatly reducing the livestock mortality rate. As a result, larger farms were able to be sub-divided into smaller viable units with higher productivity rates.

Road Train on a Beef Road

The widespread use of road trains, up to 55 metres in length, running on the new, higher standard Beef Roads to service the cattle industry soon began to influence the development of long-distance transport in Australia for all manner of goods. Today's highly productive Australian road transport industry which now utilises many multi-trailer combinations, some with gross vehicle masses up to 170 tonnes, owes much to the acceptance by the travelling public, freight forwarders and road transport authorities of the benefits of the larger vehicles and their proven safety performance.

While the program goals were focussed on the beef cattle industry, the advent of bitumen-surfaced roads connecting small rural communities, where previously road communication was restricted to rough unsealed bush tracks, provided social and economic benefits not envisaged when the program was established. Apart from the obvious benefits of easier access from these communities to larger centres for medical, social and shopping purposes, the improved travel conditions fostered the growth of new industries such as tourism (especially self-drive tourists) and other rural-based industries. Where bitumen-sealed Beef Roads passed through small townships, the obvious benefits of the improved, dust-free surface often provided the incentive for communities to embark on other town street sealing programs which would probably otherwise not have eventuated for many years.

3.3 The Australian Bicentennial Road Development Program

The Australian Bicentennial Road Development Program (ABRD) was a Federal Government program established in August 1982 to upgrade Australia's road network to a high standard by 1988 - the Australian Bicentenary. The program was funded by a new two cents per litre fuel tax hypothecated for roadworks. The Federal Government established an Australian Bicentennial Road Development Trust Fund into which this hypothecated fuel tax was paid. Money from this fund could only be used for specific roadworks approved under the ABRD program. Furthermore, the funds could only be used for construction works and not for maintenance.

Funds were provided for four categories of roads - National Roads, Urban Arterial Roads, Rural Arterial Roads and local (secondary) roads. Some funds were also provided for urban public transport projects. The Federal Government directed the funds to State and local governments which were responsible for detailed planning and construction. However, the Federal Government retained control of programming and, in particular, detailed project approval requirements were imposed. While these requirements were clearly reasonable in the case of National Roads, they resulted in unnecessary bureaucratic delays in delivery of local roadworks.

The ABRD program continued from August 1982 to December 1988 and provided for a total expenditure on new construction on Australian roads of A$4,213 million (in 1999-2000 dollars). Of this amount, 12% or A$506 million was expended on secondary roads. While this proportion was somewhat less than many local communities would have liked, the funds did provide a significant boost to new construction on secondary roads and the resultant benefits including, for example, improved wet-weather access, reduced freight costs and safer travel between communities, were widely supported. In some communities, ABRD projects were the first new construction projects provided directly from Federal Government funds for many years.

3.4 Federally-funded Infrastructure Programs for Indigenous Communities

There have been a number of these programs, the first of which was the Health Infrastructure Priority Projects (HIPP) program, sponsored by the Federal Government's Aboriginal and Torres Strait Islander Commission (ATSIC). It commenced in 1995 and was a successful initiative to deliver much-needed, large-scale infrastructure and housing to Australia's indigenous communities. The program's environmental health focus targeted improvements to community water supplies, sewerage, housing, power supplies, roadworks, stormwater drainage and rubbish disposal.

The HIPP program's A$90 million funding greatly improved living conditions in 30 communities, in all States and Territories of Australia. Coupled with this funding was an additional A$8 million contributed by other government agencies. Responsibility for the total delivery of the program was placed with the private sector, including the management of the program funding.

Successful completion of the HIPP program led the way to subsequent major ATSIC-funded infrastructure programs being undertaken using the same approach. The most important of these was the NAHS (Environmental Health) program which was again primarily a capital works program targeted at environmental health conditions. This program commenced in 1997 with total committed funding of A$220 million. Projects were linked to concurrent State and Territory projects, where appropriate.

Of these programs, over A$40 million (approximately 15%) of the funds were directed to improving secondary roads within the communities. Road improvements reduced dust-induced medical conditions and improved access to medical facilities. Standards adopted were modest, since traffic volumes were generally below 50 vpd. Pavement surfaces were sealed with a single-coat bitumen seal and roadside drainage was specifically designed to eliminate ponding.

All programs sought to closely involve local communities in both the design and construction phases, and training of community work teams was a component of many projects. Regular maintenance to ensure that these new road assets are not degraded over time is an important consideration for the communities

3.5 Transport Infrastructure Development Scheme Program

In addition to the funding support to local governments provided through the Federal Government secondary road funding grant provisions, various forms of additional, targeted and State-funded subsidy programs exist, whereby local governments and indigenous Community Councils receive additional funding for local government road upgrades, the bulk of which are secondary roads.

A typical example of these is the Queensland Department of Main Roads' Transport Infrastructure Development Scheme (TIDS) program. TIDS offers subsidies for local governments and indigenous Community Councils through a two-year rolling program. Total subsidies in 1998-99 amounted to A$64 million. In most cases, subsidies are set at 50% of project costs although, in the case of improved road access to indigenous communities, 100 per cent funding is provided.

TIDS also provides a mechanism for distribution, through the Department of Main Roads, of the Federally-funded Road Safety Black Spot program funds for works on local government and community roads. All TIDS projects are developed and prioritised in consultation with communities and local governments. The program delivers significant benefits to communities by encouraging investment in worthwhile capital works projects on secondary roads. Almost all of these projects are carried out using local community work forces, supplemented by specialist construction crews where necessary. An important spin-off of this program is the increased level of construction skills developed during delivery of the program.

4. Value for Money

4.1 Standards

In the 1960s, Australian road authorities adopted a range of road design standards predicated on category of road, expected traffic and type of terrain, in order to provide better value for money and more uniform driving conditions. In the case of secondary roads, such standards were sometimes applied too rigorously, resulting in standards of construction inappropriate for the conditions and, thus, costing much more than necessary.

The current approach to design of secondary roads is based generally on a set of design guidelines with much more flexibility in decision-making afforded to the road design engineer. Although such an approach at times results in lower travel speeds and greater limitations on passing opportunities, the ability to provide wider network improvements resulting from cost savings justifies the more flexible approach.

4.2 Low-cost Materials

More than 60% of the rural road network in Australia is not sealed. In order to provide a reasonable level of service to rural road users, the use of low-cost, naturally-occurring paving materials which have properties that fall outside normal specification limits, has become quite common. Sandstones, shales, duricrust and lateritic materials are typical of these materials. Lateritic gravels, in particular, have been shown to have excellent load-bearing capacity, except at very high moisture contents.

Frequently, these materials consist of a fine component which is often highly plastic, and a coarse component which is of relatively low strength and susceptible to breakdown during placement. Mechanical processing prior to placement is not generally undertaken, although the addition of sand is not uncommon and in-pavement processing, such as grid rolling, is often used. Pavement cross-falls are usually increased to 4% while batters are flattened to 1:6 - 1:10 where possible.

Many of these materials are, however, susceptible to corrugation and erosion under traffic, hence, various innovative bitumen surfacing techniques, including the use of geotextile reinforced seals, have been developed to provide moisture-proofing and to reduce roughness. Such sealed pavements are, however, at considerable risk in wet conditions if subjected to excessive axle loads. Close monitoring of pavement conditions and enforcement of legal load limits is critical to preserve pavement conditions when using these low-cost materials.

4.3 Accelerated Maintenance Strategies

While benefits of regular road maintenance are well recognised, it is worthwhile to consider accelerated maintenance strategies for specific secondary roadworks, where these strategies are likely to produce benefits in terms of overall cost and road life which can justify the necessary concentration of resources.

A major field trial in Australia of such a strategy has just been completed. Costing A$23 million over two years, the project involved rehabilitation works including re-seals, overlays and minor reconstruction works awarded as one contract over 260 km of secondary and collector roads. The expected benefits of this approach included economies of scale, development of innovative techniques, early intervention in the deterioration cycle, and skilling and training of the local workforce.

The project has been delivered on time and on budget. The resultant improvement in pavement roughness, elimination of rutting and cracking, and water-proofing of pavements is expected to result in significant reduction in annual maintenance costs over the next eight years. More importantly, road-user costs will fall significantly and result in improved viability of farms in this region. Also, training seminars and field operation inspections have been provided for local government staff in the area to improve their skills, knowledge and expertise.

5. Social Benefits

5.1 Employment and Training

In Australia, the economic benefits to communities arising from employment on roadworks are well recognised and are keenly sought after by local governments when Federal and State road programs are being developed. This applies whether the work is being carried out by contract or by direct labour. An important consideration is the transfer of skills to the local workforce, thus enabling them to carry out works on local government roads to a better quality and at lower cost. These skills are also important in ensuring that road maintenance activities are carried out effectively.

5.2 Health

The community health benefits arising from upgrading of rural secondary roads include reduction in dust-related complaints, food contamination and mosquito borne diseases associated with ponding of water at road sides. Less obvious benefits are dietary improvements arising from the reduction in transport costs for fresh foodstuffs and better access to outside medical assistance.

5.3 Access

Secondary roads not only have an economic function, but also a social development role that encompasses a wide range of activities such as giving households access to work, community services, education, health care, shopping and recreation. As a result, people living in rural and remote areas, where public transport is sparse, rely on their motor vehicles and travel on secondary and collector roads because they represent their social and economic lifeline to the rest of Australian society.

One outcome of the improvements to secondary and collector roads over the past 30 years has been improved access from farms and small towns to larger

centres with a better and cheaper range of facilities and services. As a consequence, a number of small towns have declined in population and services and some have even ceased to exist. The overall community benefits, however, have been positive.

6. Key Issues for the Future

Despite accounting for over 40% of total road outlays and over 75% of total road length in Australia, secondary roads, which provide the critical connectors between rural communities and the arterial network, are not as well served in terms of policy development, strategic planning and road research effort as the national and arterial networks. I believe there are significant overall community benefits to be obtained through improved emphasis on secondary roads in a number of areas as outlined below:

6.1Strategic Planning

Development and application of better tools for planning the secondary road network, including recognition of the less easily quantifiable benefits of secondary road upgrading. Strategic plans should recognise the need for ongoing maintenance funding to be factored into funds allocation procedures.

6.2 Maintenance Planning

Development of a better community understanding of the benefits of well planned maintenance, including the use of accelerated maintenance programs (possibly with private sector funding).

6.3 Funding Incentives

Local governments and community groups are more likely to allocate their funds to secondary roadworks, rather than other discretionary expenditures, if subsidies are provided by higher levels of government. Establishment of rational capital works and accelerated maintenance subsidy programs, with project priorities set using maximum local input, should be seriously considered.

6.4 Enforcement

Given the generally fragile nature of secondary road pavements, establishment of viable axle loading regimes, with regular monitoring of pavement conditions and effective enforcement of axle load regulations are critical if secondary road assets are not to be devalued through early failure. In fact, expenditure on axle load enforcement might well be the most efficient avenue of expenditure of scarce maintenance funds.

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The Roles Of Secondary Rural Roads For Economic and Social Development In Southeast Asia

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1. Introduction

1.1Background and Scope

The Southeast Asian region as a geographical area is relatively small in size but within the area, very wide and varied social cultures, racial and ethnic traditions, public administrative systems and political establishments exist. Politically, the region consists of countries such as Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philipines, Singapore, Thailand and Vietnam.

Most countries of this region have a substantial sector of their economy based on agricultural and farm produce. Typically, a large section of the population is residing in the rural areas and rural road transportation is the most popular mode of transportation. These rural roads are therefore an important part of the total national transport system and, very often, critical for the social and economic well being of these countries.

This paper intends to discuss the roles of secondary rural roads for economic and social development in Southeast Asia and the vital requirements needed for sustainable management of such roads.

This discussion is necessary since, in general, the provision, funding and management of secondary rural networks are slightly less emphasised than that of the primary road network. In addition, the authorities responsible for them may or may not have the necessary professional and technical support base that is normally available for the management of the other road networks. This places the secondary rural road networks in a less favourable position in competing for capital and maintenance allocations than the rest of the networks.

1.2 Defining Secondary Rural Roads

The secondary rural roads constitute a large percentage of roads forming the basic network of road transportation system within an Administrative District or Regional Development area. Normally, they serve intermediate trip lengths and link up towns within the district or the regional areas.

Collector roads are also roads with partial access control but designed to serve as a collector or distributor of traffic between the arterial and the local road system. They are the major roads that penetrate and serve identifiable neigbourhoods, commercial centres, agricultural farmlands and industrial areas.

For this paper, secondary rural road systems are deemed to include both the local feeder, including the access road networks that provide access to local communities and enterprises, and the collector road networks that provide access to the primary road networks in the rural areas.

2. Road Management

It seems to be a common feature of Southeast Asian countries that the responsibility for the management of roads is spread across a multitude of road authorities. Each authority individually prepares each project and budget proposal to be submitted to the approving agency. This process often results in making the overall coordination and proper planning activities more difficult.

In order to give a better illustration of the management of roads, in general and rural roads in particular, a case study of one particular Southeast Asian country is presented.

2.1 A Case Study – The Malaysian Experience

2.1.1 The Road Administration

For administrative purposes, roads in Malaysia are classified under their respective governing authorities.

Since the two major road authorities in this country are the Federal Government and the State Government, the roads are designated either as the Federal Roads or the State Roads.

2.1.1.1The Federal Roads

The Federal Roads are all roads that are declared under the Parliamentary Act, Federal Roads Ordinance (1959).

The declaration places the responsibility for provision, funding and management of these roads under the purview of the Federal Government. However, the Federal Government does allow, under the Privatisation Policy, appointed private corporations to construct a number of these roads. These corporations are then allowed to operate, manage and maintain these roads for a specific time period to enable them to recover the costs through the collection of tolls.

This category of roads is the national tolled expressways under the administration of the Malaysian Highway Authority. The tolled expressways such as the North-South Expressway, the North Klang Valley Expressway and the Shah Alam Expressway are all examples of roads classified under this category. These expressways represent the highest geometric design standard in Malaysia.

In addition to the tolled expressways, roads such as the major inter-urban highways linking the respective state capitals and the roads leading to points of entry and exit from the country are also classified as the Federal Roads. These roads are under the purview of the Public Works Department, Malaysia.

The roads within regional development schemes such as roads within the Federal Land Development Authority schemes (Felda), the Federal Land Consolidation and Rehabilitation Authority schemes (Felcra) and the Central Terengganu Development Authority schemes (Ketengah), to name a few, are also classified under this category.

Finally, minor roads leading to and within the Federal Government Establishments such as roads leading to ports, airports, military installations and government administrative centres are also under the category.

2.1.1.2 The State Roads

The State Governments do provide funds for the construction, management and maintenance of roads. The roads that are constructed and maintained using these funds are called the State Roads.

These roads include the primary roads, which provide intra-state travel between the local district administrative centres, and the secondary roads, which form basic network of roads system within a district. Also included are the urban collector roads and the minor roads within the villages and rural inhabited areas.

Rural secondary and minor State Roads are commonly characterised by their primary function of providing social links for the rural communities rather than as a result of the economic imperatives of such rural regions or areas.

2.1.2 The National Road Policy

Throughout the Southeast Asian region, various national governments implement their own independent road policy to suit their respective economic and social needs.

In the case of Malaysia, a policy was formulated, amended and improved a number of times to reflect the shifting demand on the road networks. This was in tandem with the changing national economic foundation, from the past agriculture-based economy to the now industry-based economy.

The national road policy can be traced to the first Outline Perspective Plan (OPP1) from the year 1971-1990, which was also known as the New Economic Plan (NEP). The plan posed a challenge to the government in providing good road and infrastructure networks throughout the country. The objectives of the NEP, among other things were to increase the economic status and to promote the development of the rural and under-developed regions of the country.

During this period, the priority was to implement a large number of road projects in the rural and under-developed regions. The main objective was to facilitate and accelerate the development and to tap the economic potentials of these regions.

In the second Outline Perspective Plan (OPP2) from the year 1990-2000, the demand on the function of roads was quite different and hence, the policy was modified. This second plan emphasises the improvement of the inter-urban linkages and alleviation of transport related problems arising from the rapid urbanisation of major towns and cities.

As a result, the government is providing a huge budget for the construction of new road links, upgrading the capacity of existing road networks and the construction of circular routes within the urban centres. In addition, the government is also embarking on the privatisation of new roads.

The latest policy does de-emphasise to some extent the need for new agriculture roads in the rural areas, largely due to the fact that the agricultural roads in Malaysia are already well developed and the opening of new large agricultural schemes are no longer in practice. However, the construction of rural roads to cater for social demands of the rural population remains high on the government agenda.

2.1.3 Contemporary Roles of Secondary Rural Roads

In addition to the traditional role of providing accessibility to the rural communities, the secondary rural roads also provide a host of other functions.

2.1.3.1 As rural communities' socio-economic amenity

Perhaps with the exceptions of Brunei and Singapore, the economies of Southeast Asian countries are dominated largely by the activities in the agriculture sector.

For the case of Malaysia, quite a large segment of the population is involved in this sector and the secondary road networks are provided partly to cater for the socio-economic demand of these rural communities.

The Government regards the provision of these roads is one of the essential activities carried out to provide the basic necessity for a reasonable quality of life to the rural population.

2.1.3.2 As a catalyst to alleviate poverty among the population

Even in the present context, the alleviation of poverty is still one of the major concerns of the Malaysian government. In fact, poverty alleviation by settling landless families or those with uneconomic holdings on newly developed land schemes is one of the options adopted by the authority.

In the case of Malaysia, the implementation of the Trans-Perak Area Development Project is a good example of such schemes where poverty alleviation was the major objective of the project. About 6,900 settlers' families were to benefit directly from the project and it involved the improvement of 3,700 ha of existing rice land, 6,400 ha of new rice land and 8,400 ha of tree crops. The project called for the construction of 53 km stretch of metalled and non-metalled secondary rural roads linking the project area to the West Coast Highway.

The World Bank as the financial loan provider for the scheme concluded in the bank's Project Completion Report that the objectives of improving incomes and alleviating poverty had been achieved as reflected in the improved incomes obtained by the settlers that were beyond the Malaysian poverty income level.

However, the Bank stressed that the Trans-Perak experience showed that infrastructure development must precede agriculture development in any area development project. Large-scale development of swampy tracts of virgin jungle land must be provided with the basic infrastructure like roads to facilitate ease of access and drainage and irrigation facilities before any form of agriculture development could take place. Otherwise, the cost of agricultural development would be too costly and render the economic rate of return to the project non-viable.

2.1.3.3 To promote economic growth and reduce regional disparity

The secondary rural road networks also play a very important role in promoting the growth of the agricultural production and to reduce the income disparities between the neighbouring regions.

The implementation of the Kedah Valleys Agricultural Development Project in 1983, which was aimed at increasing agricultural production and incomes of small land holders in the state of Kedah, one of the poorer states in Malaysia, and at reducing the intra-state income disparities, is a good example of such efforts.

As a supporting component to the effort, a total of 220.5 km of secondary rural and minor roads were constructed under the project to facilitate and complement the rapid transportation of expected surplus farm products from the region to the outside market centres.

The real full benefits derived from these roads are hard to quantify, but the following simple benefits were quantified at the completion of the project;

- annual passenger travel benefits
- annual freight cost savings to in-bound freight
- annual agricultural producer surplus benefits

These benefits were analysed against the annualised overall costs of the roads and the economic rate of return was found to be 18.9% as illustrated in Table-1, which further confirms the viability of the roads.

2.1.4 The Institutional Organisations For Secondary Rural Roads

2.1.4.1 Institutions for the Federal Secondary Rural Roads

In Malaysia, the provision of secondary rural roads is closely associated with the agricultural activities and regional development of the rural areas. Therefore, for the federal roads, the Ministry of Agriculture and the Ministry of Rural Development are the relevant budget controllers and are actively involved in the planning of the roads. Normally, the road planning is carried out as part of the overall agricultural or regional development schemes.

The implementation, management and maintenance of these secondary roads are entrusted to the Public Works Department Malaysia. In fact, within the Department, there is a specialised engineering design section dealing solely with the design of rural roads. Likewise, there are also in the Department, special technical units with the specific task of implementing the construction of roads within regional development schemes.

Table 1

ECONOMIC BENEFIT OF 220.50km OF ROADS IN BALING, KEDAH.
(RM Million, 1989 prices)

	1984	1985	1986	1987	1988	1989
AGRICULTURAL BENEFIT	–	–	0.0017	0.0031	0.0032	0.0032
PASSENGER BENEFIT	–	0.0300	0.4100	0.8000	0.8900	0.8900
TOTAL BENEFIT	–	0.0300	0.4117	0.8031	0.8932	0.8932
CONSTRUCTION COST	–	0.1900	3.6200	0.9100	0.3900	–
L/A COST	–	1.1100	0.3300	–	–	–
MAINTENANCE COST	–	–	–	–	–	0.0290
ACCIDENT COST	–	–	–	0.0020	0.0020	0.0020
VEH. OPERATION COST	–	(0.0070)	(0.0800)	(0.1700)	(0.1900)	(0.2000)
TOTAL COST	–	1.2930	3.8700	0.7420	0.2020	(0.1690)
NET INC. BENEFIT	0.0000	(1.2630)	(3.4583)	0.0611	0.6912	1.0622

	1990	1991	1992	1993	1994
AGRICULTURAL BENEFIT	0.0034	0.0034	0.0035	0.0036	0.0037
PASSENGER BENEFIT	0.9400	0.9800	1.0400	1.0800	1.1300
TOTAL BENEFIT	0.9434	0.9834	1.0435	1.0836	1.1337
CONSTRUCTION COST	–	–	–	–	–
L/A COST	–	–	–	–	–
MAINTENANCE COST	0.1500	0.1500	0.1500	0.1500	0.1500
ACCIDENT COST	0.0020	0.0020	0.0020	0.0020	0.0020
VEH. OPERATION COST	(0.2200)	(0.2300)	(0.2400)	(0.2400)	(0.2600)
TOTAL COST	(0.0680)	(0.0780)	(0.0880)	(0.0880)	(0.1080)
NET INC. BENEFIT	1.0114	1.0614	1.1315	1.1716	1.2417

ECONOMIC RATE OF RETURN = 18.90%

Maintenance cost of RM 5,000/km is the amount required to properly maintain the road. (JKR estimate)

This table is extracted from the World Bank Project Completion Report, Kedah Valleys Agricultural Development Project.

ECONOMIC BENEFIT OF 220.50km OF ROADS IN BALING, KEDAH
(RM Million, 1989 prices)

	1995	1996	1997	1998	1999
AGRICULTURAL BENEFIT	0.0038	0.0039	0.0041	0.0042	0.0043
PASSENGER BENEFIT	1.2100	1.2900	1.3800	1.4700	1.5600
TOTAL BENEFIT	1.2138	1.2939	1.3841	1.4742	1.5643
CONSTRUCTION COST	–	–	–	–	–
L/A COST	–	–	–	–	–
MAINTENANCE COST	0.1500	0.1500	0.1500	0.1500	0.1500
ACCIDENT COST	0.0020	0.0020	0.0020	0.0020	0.0020
VEH. OPERATION COST	(0.2700)	(0.2900)	(0.3100)	(0.3500)	(0.3700)
TOTAL COST	(0.1180)	(0.1380)	(0.1580)	(0.1980)	(0.2180)
NET INC. BENEFIT	1.3318	1.4319	1.5421	1.6722	1.7823

	2000	2001	2002	2003	2004
AGRICULTURAL BENEFIT	0.0044	0.0045	0.0046	0.0047	0.0048
PASSENGER BENEFIT	1.6400	1.7300	1.8100	1.8900	1.9800
TOTAL BENEFIT	1.6444	1.7345	1.8146	1.8947	1.9848
CONSTRUCTION COST	–	–	–	–	–
L/A COST	–	–	–	–	–
MAINTENANCE COST	0.1500	0.1500	0.1500	0.1500	0.1500
ACCIDENT COST	0.0030	0.0030	0.0030	0.0030	0.0030
EH. OPERATION COST	(0.3900)	(0.4100)	(0.4300)	(0.4500)	(0.4800)
TOTAL COST	(0.2370)	(0.2570)	(0.2770)	(0.2970)	(0.3270)
NET INC. BENEFIT	1.8814	1.9915	2.0916	2.1917	2.3118
ECONOMIC RATE OF RETURN			18.90%		

Maintenance cost of RM 5,000/km is the amount required to properly maintain the road. (JKR estimate)

The State and the District Public Works Department also assist the Public Works Department Malaysia in carrying out the management and maintenance of the Federal Roads.

2.1.4.2 Institutions for State Secondary Rural Roads

For the majority of the State Roads, the responsibility for planning, implementing, managing and maintaining of the roads is left entirely to the respective State Public Works Departments.

However, the District Administrative Offices also construct some of the collector and most of the village road networks and for these roads, maintenance budgets are channeled directly to the respective district office.

2.1.5 Management of the Rural Secondary Roads

Generally, in regards to the management and maintenance of existing roads, the Government of Malaysia does not accord any distinction between the secondary rural roads and the rest of the roads in the national network. As such, the fund for maintenance is allocated *en bloc* to the road management agencies with the specific purpose of implementing the maintenance program for all roads, rural or otherwise.

As a comparison, the procedure for disbursement of the development fund is rather different. In this case, the Government as a policy provides a separate sub-division of the fund to be used solely for the construction of rural roads. In this manner, the funding for rural roads is assured.

For this reason, presently there is no specific approach or methodology solely adopted the management of rural roads in Malaysia. In fact, the same methods and criteria that are used to evaluate the maintenance needs of highways and primary roads are being used to evaluate the secondary rural roads.

2.1.5.1 The Secondary Roads under the Federal Government

As mentioned earlier, the Public Works Department Malaysia is the custodian of the publicly managed Federal Roads. Excluding the privately operated roads or tolled roads, the total length of these roads is about 15,000 km.

Obviously, a proper decision-making support tool is needed to assist the road manager in carrying out the management functions, often needed in any road management program. The department therefore, adopted the Pavement Appraisal and Management Suite, or in short PAMS.

1.1.2.1.1 Pavement Appraisal and Management Suite (PAMS)

PAMS is a pavement management system that caters for both the network and the project level needs of road management organisation. These needs include,

- planning of pavement standards, maintenance policies and funding levels
- assessing economic goals and assigning priorities
- annual programming and budgeting of pavement works and treatment design
- evaluating the impact of sub-optimal budget on network serviceability and system costs.

The life-cycle conditions and costing of each individual section of the road network can be simulated in PAMS for planning periods of 2 to 20 years under a user-specified policy and environment.

The outputs from PAMS are being used by the Public Works Department Malaysia to justify sufficient allocation from policy makers of road maintenance budget. The outputs are also used to establish the optimum maintenance strategy to obtain the maximum net value from investing in the network.

2.1.5.2 Secondary Roads under the State Government

As mentioned earlier, the management of State Roads is exclusively under the State Governments, so the Federal Government's concern is only regarding the allocation of the State Road Grant.

To facilitate an orderly disbursement of this grant, a computerised central register of all state roads called the Malaysian Road Record Information System or MARRIS is kept and updated annually at the Federal Treasury.

The grant is distributed in proportion to the length of existing state roads within each state as recorded in the MARRIS. The respective State Governments then reallocate the budget to the various state agencies such as the State Public Works Department and Local Government Authorities for implementation. To date, about 45,000 km of roads is under this category.

3. Road Construction and Maintenance Funding

For most countries in the Southeast Asian region, the allocation for road development and road maintenance budgets is typically separated.

And in the case of Malaysia, as highlighted in the case-study above, there are even significant differences between the disbursement of development funds and the maintenance funds.

As for the development funds, the needs to invest in the construction of rural roads are fully recognised by the policy-makers. This is clearly illustrated by the fact that the Government as a matter of policy, consistently allocates a sizeable amount of funds to be used solely for the construction of rural roads.

In the case of maintenance funds, the situation is rather different. All roads are evaluated on equal footing using the evaluating criteria that are best suited to the highways and roads of bigger traffic volume. Since rural roads are not typically constructed based on the criteria of traffic volume, they are significantly handicapped in the race for budget allocation.

The sources of funding for roads are listed as follows;

3.1 Funding by Public Expenditures

The Southeast Asian Governments generally finance the road construction and maintainance programs by public expenditures generated by domestic funds.

The common practice is that Government collects taxes to generate general revenue fund for general purposes. These taxes include 'the road user charges' which are the indirect taxes or charges levied on the purchase, ownership and operation of motor vehicles. Conceptually, road user charges should reflect marginal costs for the use of roads in order to promote efficient allocation of resources. However, taxes on road users are levied in most countries for general revenue purposes and are not normally related to policy objectives for recovery of the cost of road infrastructure.

The funds needed for financing the road construction and maintenance activities are then disbursed through the annual budget allocation.

3.2 Loans by International Financial Agency

In this region, international financial agencies such as the Asian Development Bank (ADB) and the World Bank are also very active in providing long-term loans to the national Governments for the development and maintenance of roads.

In addition to the international agencies, donor nations do contribute some funds for construction and maintenance of roads and road related infrastructures in the selected countries. The arrangement usually was done through bilateral agreement between the donor and the recipient Governments and was funded under the donor's respective international development assistance program.

3.3 Private Sector Financing

Several countries have recently attempted to involve the private sector in the development of toll highways. However, since the success of this program initially depends on the heavy traffic volume, in some countries the Governments are finding it difficult to attract private capital for toll road development. This is especially true for rural secondary roads where the volume of traffic is generally relatively low.

In Malaysia at least, the privatisation of road projects is gaining momentum as more and more projects are given clearance by the Government to proceed and a number of others are waiting for approval.

4. Issues On Secondary Rural Roads

4.1 Formulation of strategic policy

In terms of traffic volumes, secondary rural roads do not command a high traffic volume as normally enjoyed

by the expressways, highways and the primary roads. The total volume of freight and passengers transported on these secondary roads are relatively low since the regions served by these roads are sparsely populated and the traffic demands are distinctly seasonal.

Incidentally, the allocations of maintenance funds are very often in favour of the more important, higher traffic and freight volume roads than their rural counterparts. As a result, the rural roads get less attention, lower budgetary priority and end-up less well maintained.

A clear policy on the management and maintenance of these secondary rural roads is therefore appropriate to ensure that the roads continue to play the vital roles that they always play in the economic and social development of rural communities.

Some of the pertinent issues regarding the policy may be very delicate and demand careful deliberations by the policy-makers but avoidance of these issues will result in dire consequences. Examples of those issues are briefly elaborated below.

4.1.1 Integration of institutional functions

As mentioned earlier, the responsibility for managing the roads is often divided among the various national, states and provincial authorities. Generally the authorities are performing identical functions in a very de-centralised manner. Each authority normally lays down their own policies and rules within their specific area of operation.

Obviously, there are merits to de-centralised road management, but for organisations that perform identical functions, de-centralisation may lead to a disparity in technical know-how, gross policy inconsistency and inter-organisational rivalry. These shortcomings may lower the efficiency of the overall road management functions and since the primary roads are of higher priority rank, the secondary roads may then end-up having to bear the full impact of the shortfall.

It is therefore desirable that a national road-governing agency should be established to ensure a more efficient and equitable allocation of maintenance funds to all categories of roads. The agency can do this by insisting that the various road authorities adopt a common policy on priorities, standards, procedures and requirements in dealing with all issues pertaining to road management.

4.1.2 Financing of roads maintenance

It is a common occurrence that governments have all given high priority to the allocation of funds for the development of road transportation infrastructure. The reasons for these are sometimes political and social as much as economic. However, it is sad to note that the resources allocated to maintenance and the attention given to the questions of management and organisation have not been accorded the same degree of priority and vigour.

In fact, in most countries there has been an imbalance in fund allocation between capital expenditures and maintenance, creating a backlog of infrastructures that are in need of maintenance. And again in this situation, the secondary rural road would normally end-up with a long list of deferred maintenance programs. Extra cost normally generated whenever one has deferred maintenance and this could have been avoided, had a more balanced allocation been practiced.

It is worthy to note that, road rehabilitation and maintenance programs often have far higher internal rates of return than road capital expenditures.

4.1.3 Professional and technical support base

Despite immense improvement in regular data collection, processing and retrieval systems that are available in the market, the use of these tools for rural roads management is still lacking. In fact, there are still large information gaps for rural road networks and this creates major limiting factors in providing and managing better rural roads.

Presently, it seems quite normal for the secondary rural roads not to have regular data collection programs such as road traffic count surveys or traffic origin destination surveys on a regular basis. The axle-load study programs, which would give better information on the current capacity of existing road, are non-existent or, at best, very limited on the rural roads.

4.1.4 Enforcement of Road Regulations

In the Southeast Asian region, compared to the western developed nations, the axle load capacities of secondary rural roads are rather low and this has resulted in countries within the region adopting relatively low weight restriction regulations.

The problem is further aggravated by the fact that the equipment, facilities and personnel that are needed to strictly enforce the regulations along the route are not available on these roads. Not surprisingly, overloading is therefore very common in rural roads.

It is a widely accepted concept that licensing weight restriction on trucks and lorries, imposing weight restriction regulations on roads and limiting the movements of heavy loads on the road together with strict enforcement by the enforcement agency do contribute to the lessening of expenditure on maintenance.

4.2 Roles of International Financial Agency

The international agencies actually provide quite a sizeable amount of funding for the national

Governments to develop and maintain the road networks in this region. It is obvious, therefore that they have a vital role to play in achieving maximum benefits from every investment made.

This objective would be possible by:

- persuading the Governments to justify their budget proposal whenever they request financial assistance to support their expenditure programs. This will generally strengthen financial discipline and improve the use of financial resources.

- supporting programs that attempt to redress the imbalance in priority between the highly trafficked road networks and the less highly trafficked road networks but still very vital to the well being of the agricultural-based economies of the Southeast Asian countries.

Nevertheless, it should be noted that projects funded by the international agencies suffer less likelihood of financial cuts compared to publicly funded projects.

5. Conclusion

In conclusion, as illustrated by the Trans-Perak Area Development Project, for any large-scale agricultural development program, the provision of basic infrastructure such as the secondary rural roads is of primary importance to ensure a successful and viable economic rate of return. The capital investment in the construction of rural secondary roads is definitely worthwhile as demonstrated by the Kedah Valleys Agricultural Project. In this project the capital investment is yieding a high rate of return, in addition to other economic and social benefits to the project area.

In spite of all these, the future of the secondary rural road is still less certain compared with the other category of roads. As highlighted in this paper, there are relevant issues still needed to be addressed by the policy-makers, project proponents, financial provider and project implementor of the rural secondary roads. The final outcome of these outstanding issues could very well determine the future roles of the rural secondary roads.

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Socio-Economic Impact Of Rural Roads In South Asia

Evidence from studies and lessons from experience

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I. Introduction

Development of rural roads and rural transport plays a key role in the economic and social development of rural areas, mainly through improving access to social and economic infrastructure, and by facilitating awareness and attitudes conducive to development. This is a principle widely accepted in South Asian countries which give considerable importance to investing in rural road networks and in trying to improve their maintenance and sustainability.

While there is general acceptance of the positive impact of rural roads, it is often difficult to quantitatively establish how rural roads development promotes economic development, or reduces poverty. This is an issue which worries planners in developing countries and officials of international funding agencies. Considerable work has been done in Asia on these issues, and more work is ongoing. I shall try to present in this paper an overview of the findings from some of these studies.

I shall present results of various impact studies from a few countries, mainly Bangladesh, India and Bhutan, showing the strong linkage between rural road investments and rural development. I shall also present a brief outline of ongoing work in doing more in-depth analysis with improved methodology to further study such linkages, and in quantifying, for the first time, some of the social benefits from improved rural access. Lastly I shall discuss practical lessons we have learnt from the World Bank's work in these countries in designing better rural transport projects to maximize impact on poverty alleviation and economic development; and in making them more effective and sustainable.

I take this opportunity to acknowledge the work of the many authors I quote in this report and also the valuable technical and research support received from Ms. Harpreet Kaur while preparing this paper.

The selection of the countries has been influenced by my close involvement with work in these countries, both in impact studies and in designing/funding/ supervising rural roads and other transport projects, through the World Bank. Indeed, the results I quote include studies done by many others.

2. Results of past studies

2.1 Impact study results from Bangladesh

Bangladesh is a country with a large network of rural roads. It has about 8400 km of what is called B-type rural roads, which are sub-regional roads linking Thana level (sub-district level) offices and markets to the regional roads; and about 100.000 km of other lower level roads, within villages, between villages and village to thana markets; much of the network has been built under the Food –for –Work program, and is not fully developed; they are predominantly earth roads, many of them lacking drainage structures. Bangladesh has followed a good strategy for improving these roads on a selective basis, focusing primarily on what is called the "growth-center connecting roads' or the B-type rural roads, while also improving the lower type roads through an active policy of community participation. The Local Govt. Engineering Dept. (LGED) in Bangladesh, has built up a creditable record in developing and maintaining this vast network through considerable donor support. Indeed, Bangladesh's rural road network still needs massive investments to cope with the demands of rural development in this very populous and poor country.

There have been several studies assessing the impact of rural roads on various socio-economic variables in Bangladesh villages. Some of these studies are discussed below.

(a) IFPRI/BIDS Study : Development impact of rural infrastructure (R. Ahmed and M. Hossain, 1990)

This study is based on a pilot survey of 129 villages in various parts of the country and presents data on the access of these villages to various forms of transport.

The study categorized the villages in its sample into two groups based on an aggregate index which reflected

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This study is based on a pilot survey of 129 villages in various parts of the country and presents data on the access of these villages to various forms of transport.

The study categorized the villages in its sample into two groups based on an aggregate index which reflected the ease of access to various services such as markets, schools, banks and local administrative offices. Villages which had better than average access were classified as developed.

Developed villages were found to be significantly better off in a number of areas including agricultural production, household incomes, wage incomes of landless labor, health and participation of women in the economy. A summary of key impacts is provided in Table 2.1.

Table 2.1: Impact of Improved Rural Access

Indicators of Impact on Rural Economy	Percent Higher in Accessible Areas
Farmgate price of rice	7%
Household Income	8%
Fertilizer use	92%
Income per acre of field crops	20%
Wage Income of Landless Labor	36%
Percentage of female workers	135%

As you can see, these are significant results, which speak for themselves!

(b) Impact studies under IDA/SDC funded Rural Roads and Markets Improvement Project (RRMIMP –1: see World Bank 1996)

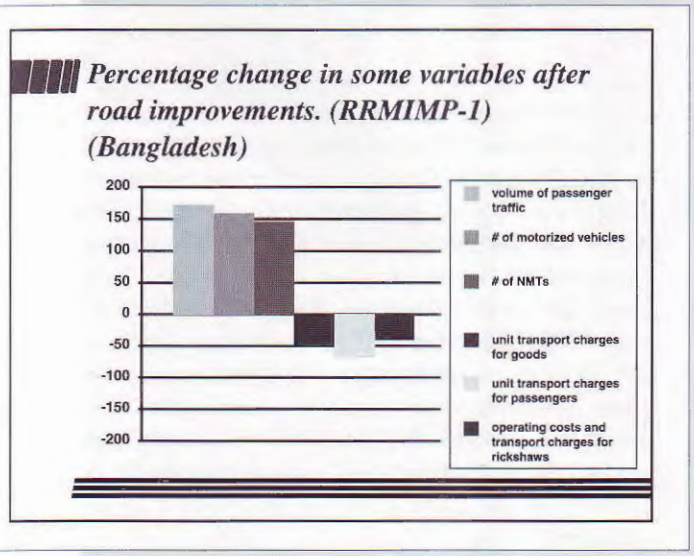
A socio-economic monitoring and evaluation unit in LGED carried out a number of impact studies during the implementation of this project which was completed in 1998. A selection of these results is presented in the World Bank / LGED report " Bangladesh Rural Infrastructure Strategy Study, 1996", co-authored and coordinated by T. Pankaj (Also see (d) below). These impact studies show that rural road improvements:

- Generated a substantial increase in the total movement of people and goods; the volume of both cargo and passenger traffic (in ton-km and passenger- km) has increased by over 70% in the case of cargo and over 170% in the case of passenger traffic after a year of development.
- Reduced transport charges on improved roads; unit transport charges for goods and passengers have decreased by 48% and 69% respectively.
- Resulted in a transfer to more efficient modes, with substantial growth in vehicular traffic, both non-motorized and motorized, and a reduction in pedestrian and bullock cart trips.
- Substantially increased the number of motorized and non-motorized vehicles using the improved roads; motorized vehicles increased by 160% and non-motorized vehicles increased by146%.
- Increased the relative share of traffic volumes (Tkm and Pkm) carried by motorized traffic from 47% share to 73% share after road development in the case of cargo; and from 22% to 53% in the case of passenger traffic.
- Reduced the operating costs and transport charges for rickshaws and rickshaw-vans by about 40%, because of the provision of a smooth running surface.
- Stimulated the operation of a bus service for the first time.
- Produced significant new employment for the poor through direct and indirect impacts. Actual employment impact surveys show that the project components valued at US$64 million would create, on full project completion, about 18,000 person-years of direct employment through labor-based construction activities, and indirect employment at a rate of about 6000 person-years per year (roadside shops, transport activities and road maintenance activities), which would continue during project life.

Some of the impacts are illustrated in Figure 1.

Based on a partial analysis, completion studies under RRMIMP-1 subprojects show an average 22 percent economic rate of return from road projects. This estimate takes into account only easily quantifiable transport cost savings from road improvements and spoilage reduction due to market improvements; it ignores several other economic and social benefits from increased access to schools, health and banking facilities and from more employment creation. If these could be quantified the economic rate of return would obviously have been much higher.

Figure 1



(c) Bangladesh: Rural Non-Farm growth and targeted credit interventions , Shahidur R. Khanker, 1995)

This study on non-farm growth uses household survey data from Bangladesh. One of its findings is that better quality roads such as paved roads increase **rural non-farm production**, especially in trade and services. This study clearly brings out the importance of paved roads. (A paved road refers to gravel or tarred road as against seasonal earth roads.) For example, it shows that value added in trading is at least 70 percent higher in villages with a paved road than in villages without a paved road. Value added in services is 22 per cent higher in villages with a paved road than villages without a paved road.

(d) Bangladesh: Rural Infrastructure Strategy Study (World Bank, 1996)

The results from various studies presented above demonstrate that there is a strong association between economic well-being and rural infrastructure improvements. To assess whether such an association also exists at the macro level, this strategy paper utilizes a cross-country district level regression model to test the hypothesis that better rural road infrastructure is associated with higher agricultural output. The study uses cross-sectional data for 64 districts of Bangladesh to test its hypothesis.

The model takes a logarithmic form where agricultural output per square kilometer of a district is regressed on density (per sq. km) of various types of roads and growth centers which are correlated with infrastructural investments. The model is estimated using the ordinary least squares (OLS) method.

The results of this estimation clearly show that density of paved and good roads has positive and significant correlations with agricultural production. The central message of this exercise is that **roads matter and better roads matter more**. Although the results are tentative, they do suggest that investments in promoting better roads are good investments, and help agricultural production.

2.2 Impact study results from India

India has over 2 million km of rural roads, connecting its 0.6 million villages. Under the federal system of Government, rural roads are under the State Governments, with greater delegation given recently to local governments at the village/panchayat level. Half the villages in India lack an all-weather road connection, and the existing road network in the country is underdeveloped in many respects. Providing better rural road access to its vast rural population of about 800 million is one of the biggest challenges facing Indian economy today. In view of the huge investment costs involved, it is also essential to have good research studies and analytical tools for making rational choices among alternative investments in the sector.

In the following sections, I discuss some impact studies (amongst many) to illustrate the socio-economic impacts of rural roads in India.

(a) How infrastructure and financial institutions affect agricultural output and investment in India. (Binswanger, Khandker and Rosenzweig , 1992)

This is a highly regarded research study using sophisticated statistical methods and econometric analysis. This study has sought to quantify the interrelationships among the investment decisions of government, financial institutions and farmers and their joint effects on agricultural investment and output. One of the major objectives of this study was to analyze the effects of infrastructure and other factors on agricultural output in India.

The study is based on data from 85 randomly drawn districts, belonging to 13 sates of India – Andhra Pradesh, Bihar, Gujarat, Haryana, Jammu and Kashmir, Karnatka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh. The period covered in this paper is the agricultural years 1960-61 to 1981-82. The authors perform a very careful and rigorous econometric analysis of panel data to determine the effect of various variables on agricultural output.

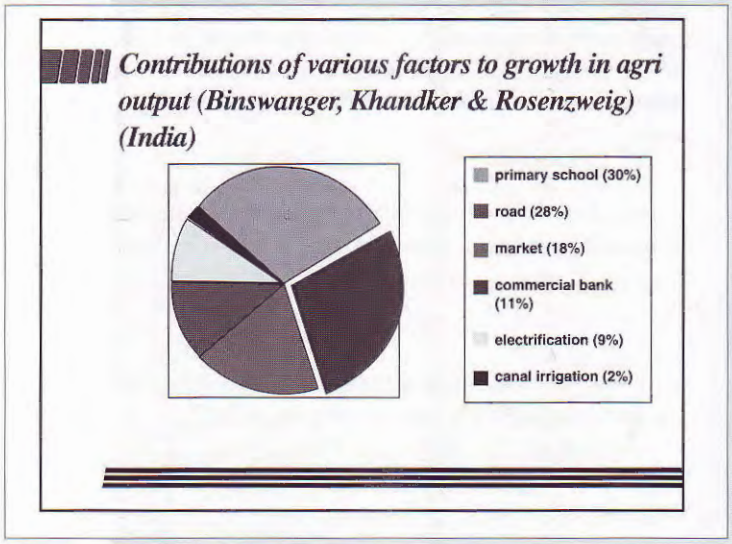
The most significant finding of the study is that among various contributing factors to the growth of agricultural

output, road access had the second largest influence at 28%, next only to the influence of primary schools, which was 32%. The third, fourth and fifth level contributors were the presence of markets (18%), presence of commercial banks (11%) and rural electrification (9%) respectively. Other factors such as canal irrigation and price of fertilizers had much less influence.

This finding about the dominant role of primary education and rural roads in contributing to agricultural productivity and output is very significant. Since rural roads provide better access to primary schools, the role of rural roads in the dynamics of rural development becomes doubly significant.

The contribution of various factors to the growth in agricultural output is captured in Figure 2.

Figure 2



(b) NCAER study : Socioeconomic impact of roads on village development.(Study team: Alok Nath Bansal and B. R. Patil, 1979)

This study was initiated by the Rural Roads Committee and sponsored by the Planning Commission and Ministry of Shipping and Transport in India to evaluate the socioeconomic impact of rural roads on the development of villages. It is based on secondary data collected in 1971. The main objective of the study was to conceptualize and assess the socio-economic impact of roads in terms of indicators, variables and factors within the limits of available secondary data.

Analysis is done at two levels of secondary data. Initially the district level secondary data available for 356 districts of the country is used for district level analysis. For village level analysis, data pertains to 1662 villages from 20 community development blocks in 20 states of the country.

Socio-economic variables used in this analysis include employment and migration pattern, literacy rate and education growth, health improvement, extension contacts, communication, institution building, occupation mobility, land concentration, agriculture outputs/per hectare yield, marketed and marketable surplus, electricity consumption, agricultural and non-agriculture wages, land use pattern and irrigation utilization of production inputs, growth rates in secondary and territory sectors, land prices and so on. These variables were compared against the road development index constructed for the district level analysis. For the village level analysis, the impact of accessibility on these variables was sought to be estimated.

District level analysis:

At the district level, density of roads measured in terms of surfaced road mileage per hundred square kilometers of area was used as an indicator of road development.

A correlation analysis of district-level data shows that the level of road development is significantly correlated with selected socioeconomic variables. In brief, it is possible to say that the road access is strongly linked with:

1. Diversification in agriculture, with more cash crops.
2. Intensive use of land for cultivation.
3. Expansion of secondary and tertiary sector activities.
4. Increase in literacy rates.

Village level analysis:

For the village level analysis accessibility was measured in terms of:

- Distance in monsoon rather than in dry season to the nearest district, state or national highway
- Percentage, i.e., less than or more than 50% *pucca*[1] road which means the ratio of installed, tar or concrete portions of road to *kutcha*[2] or non-motorable portion. The accessibility index varied from 1 to 6.

Analysis was done in three parts. Initially, correlation analysis was performed for road development index and 16 socio-economic variables, followed by the multiple regression analysis between the road

[1] *Pucca*, in India, refers to an earth or seasonal road, non-motorable in rainy season.

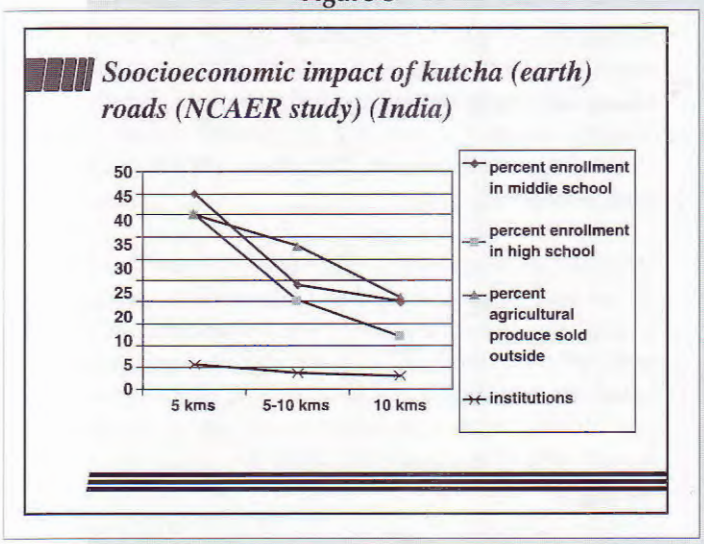
[2] *Kutcha*, in India ,refers to a paved or an all season road.

development index and 16 variables, and finally discriminant analysis was done for these 16 variables in between village groups defined as per the road development index.

The results of correlation analysis clearly show that the total accessibility index and most indicators of socio-economic improvements are positively related. The positive relationship is further confirmed by the results of multiple regression analysis . In case of kutcha roads, the results show that after controlling for the effect of population, literacy, irrigation and institutions as exogenous variables, accessibility has a direct and independent effect on the use of fertilizers, percent agricultural produce marketed and percent enrollment in secondary school.

A comparison of means across various accessibility groups also shows that at the village level as the accessibility to district, state or national highway improves, there is a positive change in socio-economic indicators as well. Specifically, as accessibility improves, there is an increase in percent use in fertilizer, use of seeds, percent agricultural produce sold outside the village, visits of health and government officials and percent enrollment in middle school and high school as well as many other socio-economic indicators. Changes in some selected socio-economic indicators in case of kutcha roads are shown in Figure 3.

Figure 3



2.3 Impact study from Bhutan (Arkesteijh et al, 1996)

Bhutan is a mountainous country on the Himalayan range, with a population of only 640,000, with an average population density of about 14 per sq.km. Its per-capita income is about US $ 650. Bhutan is passionately devoted to maintaining high environmental quality and has 72% of its land under forest cover. It also wants to ensure good quality of life in its rural areas. It has a total road network of 3375 km, including about 1300 km of feeder roads. All roads are managed by the Department of Roads (DOR) under the Royal Government of Bhutan (RGOB), with the support and involvement of local governments at the district and village level. The roads are maintained reasonably well. About 85 % of the people live in rural areas , where average walking distance from village to nearest road is about 2 to 3 days. RGOB is keen to provide the rural communities, on a selective basis, with road access to schools, health centers and markets, so that the rural communities will continue to live in the rural areas and keep its farm economy thriving, which is a major source of the country's wealth and income. Bhutan faces a major challenge in providing such rural access roads, with proper environmental standards, in view of their high costs.

The study, **Grain, Money and Labor** (Marlen Arkesteijn, Zhemgang Dzongkhag Administration and ISDP, 1996) was an in-depth socio-economic study of Zhemgang district in Bhutan. The study was funded by Norwegian Economic Development Agency (NEDA) in the context of preparing an integrated development project in the district.

Data from the study shows that two neighboring areas in the same district, which are similar in most socio-economic aspects except accessibility, show very different income levels and school enrolment levels; the levels being higher in the more accessible area. This is illustrated in Table 2.2 and Figure 4 below. In the following table, the data for 'accessible area' relate to the Trong Gewog (group of villages), and 'inaccessible areas' cover the remaining 5 Gewogs in the same district, the main difference among these areas being relative ease of road access.

Figure 4

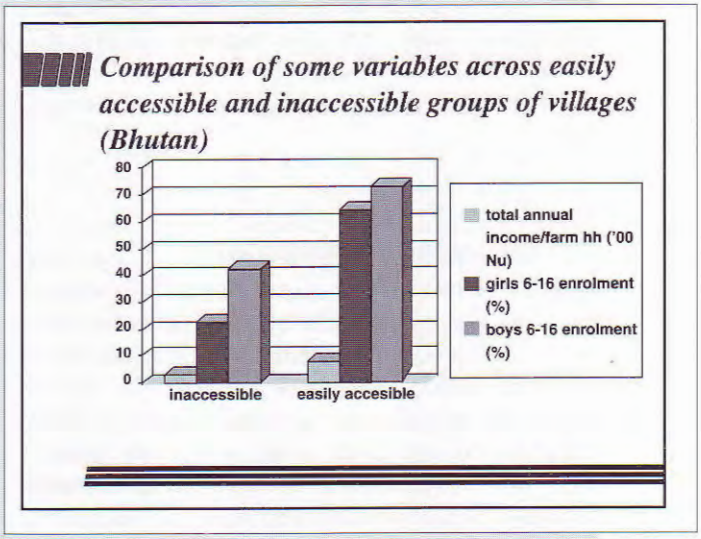


Table 2.2

Scenario	'Accessible' (0-0.5 days walk to nearest road) (Trong, Gewog)	'Not Accessible' (1-3 days walk to nearest road) (average of 6 remaining Gewogs in same district)
Distance to nearest road (walking time)	0-0.5 day	1-3 days
Average annual income/farm household	8,080 Nu	3,270 Nu
Enrollment of boys (Age 6-16)	73%	42%
Enrollment of girls (Age 6-16)	64%	22%

3. More in-depth studies in progress

Practitioners in the field of rural road planning and investments in South Asia, and in agencies like the World Bank and other financing agencies, have realized that while the past studies are valuable in establishing a strong linkage between rural roads development and rural socio-economic development, there is scope for further improving the study methodology and doing more in-depth studies to bring out the long-term impact of rural roads. Also, there is need for more clearly establishing a linkage with poverty alleviation, and in quantifying some of the social benefits from improved access to social infrastructure, such as schools and health facilities. It is recognized that more studies with a better statistical design are needed. Better methodology for defining control areas and for netting out influences of other factors has to be pursued in studies. The World Bank , in association with other interested agencies and governments, has recently taken special initiatives in starting such studies; in many countries inside and outside of Asia. I would like to discuss three such studies, now under way, in Bangladesh, India, and Bhutan. Subject to availability of funding , two more similar studies are currently planned for Nepal and Pakistan. One other major ongoing study is in Vietnam, which is not discussed here.

3.1 Ongoing study in Bangladesh

As part of the Second Rural Roads and Markets Improvement project (RRMIMP_2) funded by IDA , SDC, and Govt. of Bangladesh, an in-depth socio-economic impact study is being undertaken by the Bangladesh Institute of Development studies (BIDS), in close collaboration with LGED, the project implementing agency and the World Bank. The study will cover impact of rural roads, market improvements, and river jetty improvements, all as project components. It will study both short term and long term impacts, and both direct and indirect impacts, including impact on the living condition of women and on poverty levels.

In the case of roads, it will select 10 project roads, and have socio-economic surveys of affected households before the project, one year after road completion, and 3 years after road completion ; it will also have four roads carefully selected using objective criteria, as control roads, with no project investments or other similar investments during the period. One roadside village has been selected for each of the 14 sample roads; one remote village has also been selected for each of the sample roadside village for assessing the distance effect of infrastructure development. Thus there are about 28 study villages.

Three survey instruments will be used: (1) household survey (2) market, community and facility survey, and (3) transport survey. Fifty households are selected from each village for detailed surveys, based on stratified random sampling procedures. The stratification was done according to land-ownership and occupational categories.

The method to be used to quantify the impact of road is a "before and after" comparison combined with "with-without" comparison. The changes in the program villages before and after road improvement will be netted out by changes in control villages during the same period to arrive at the net impact due to road improvement in program villages. This, of course, assumes that changes in other parameters remain the same during the study period in both program and control villages, which is very unlikely. To address this problem, changes in other parameters

will be controlled through a regression technique that nets out all other changes in villages due to their interactions, and quantifies the net impact of road development.

The bench mark surveys were completed in 1998. Further surveys are in progress. The study will continue for about 5 years, which is the implementation period of the main project. We expect both interim results and a comprehensive final report. The study is being done by a well-known research institution in Bangladesh, with supervision from World Bank experts, and we expect good quality results, and answers to many questions on the type and intensity of socio-economic impact from rural infrastructure improvements.

3.2 Ongoing study in India

A major study on socio-economic impacts of rural roads has recently been started in India, which will last about 9 months, with the final report expected around June 2000. The study is funded through the Swiss Development Cooperation (SDC) and is conducted by the Center for Social Science Studies (CSSS) in Pune, which has a very good track record in social science research in India. The study has been designed and is being supervised by the World Bank as part of its effort in advancing knowledge and understanding of rural road development impacts.

The India study will follow the case-control methodology, and compare socio -economic indicators of areas with and without rural roads, other things being similar. It will seek to show impact of different levels of road development, such as having a basic road with seasonal use only, or an all-weather unpaved road, or a black –topped road. It will follow rigorous statistical sampling procedures to maximize the quality of the results . It will make special efforts to study /quantify impact of road access on enrolment and education levels, health facilities and their use, and farm and non-farm production and marketing. It will also investigate indicators related to 'Knowledge, Attitude and Practices' (KAP), since roads also help in better transmission of knowledge and understanding through better social interaction and improved access to extension services. It will also make a special study of linkage with poverty, especially in relating the number of "households below poverty line" in each study area to road development.

Interviews, study of secondary data, and direct household surveys will form part of the study procedure. It will cover areas in two large Indian States, Maharashtra and Gujarat. Two blocks (Tehsils) will be selected from each State. The blocks will show tribal /hill areas (for comparison within that region), and also areas with different (more representative) geographical and cultural features. Comparison will be done within each type of area. The study will also analyze time-series data from secondary sources for selected villages.

The total of four blocks selected will have a total data base of about 500 villages, and a population of about 900,000. Secondary data and census data about all villages will be used for the analysis. About 120 villages will be selected for detailed analysis (30 from each block) , based on their levels and types of road access. Village profile information will be compiled for all these villages. Detailed surveys will be conducted , with village level government officials, other institutions (banks, schools, etc,) and also with households. Thirty households will be selected from selected sample village, the household samples being selected from village-wide household census. The study would have detailed survey of about 3600 households in the overall study area.

The research institution conducting this study has done other major field surveys and studies on socio-economic issues, and we hope a high-quality study report will result from the ongoing effort, which would throw more light on the nature and extent of rural roads development.

3.3 Ongoing study on measuring socio-economic impact of rural roads in Bhutan

This is a study undertaken as part of the economic evaluation of a rural access project proposed to be funded by the World Bank. The main work was done during 1999 by World Bank staff /consultants (Messrs. T. Pankaj and Eddy Bynens) with support in data collection and analysis by local consultants in Bhutan (Kyingkor consultants). A detailed report on this study will be published shortly. A brief description of the main features of the study and its results is presented below.

For the first time in World Bank's work on rural road economic analysis, **this study attempts to quantify economic benefits from improving rural road access to social infrastructure** such as schools and health centers, in addition to benefits from reducing transport costs, and increasing net agricultural income. This study starts with the data on accessibility presented in the ISDP study (see 2.3 above). By comparing school enrolment levels in two adjacent areas, one with road access and another without road access, other features being similar, it was found that the accessible area has much higher

school enrolment levels for both boys and girls. It also had higher income level, and a higher proportion of marketable crops.

The accessible area has a walking distance of about 0 to 0.5 day to the nearest road, while the inaccessible area has a distance of about 2-3 days walking to the nearest road, reflecting the extremely difficult access problems in rural Bhutan where about 85% of Bhutan's population lives. In the absence of road access, transport is done mostly using mules, and it is difficult to build schools or attract teachers to work in schools in such inaccessible areas; moreover, the boys generally spend most of the day in assisting in transport tasks, with no time to attend school, and parents are reluctant to send girls to far-away boarding schools, though they are available at highly subsidized rate by the government.

The study estimated that the proposed new project road (a 37 km rural road, from Dakpai to Buli; considered typical of most project roads in Bhutan) would enable 70 to 100 additional children to go to schools annually, after the road is completed and new schools are built as per government's plans.

It is well-known that wider education, particularly among girls, has far-reaching impact on both social and economic development, such as improved productivity, positive attitude to change, and greater acceptance of family planning leading to reduced population growth rates in later years. In the study, however, we have limited the analysis to quantifying incremental life-time income earned by the additional children receiving education (after netting out school investments, and other education and training costs). Without the road, these children would have remained without education, and their income would have remained relatively low, with only moderate increases over time; with education , their income level will be higher, depending on the drop-out rates at different education levels. The study used an education model and income model applicable to Bhutan's current education and income experience, with some reasonable projections for the future. The study also quantified health benefits from improved access, (from reduced sick days, and reduced death rates) , based on available local data. The various quantified social benefits amounts to about 30% of the total benefit stream estimated for the project.

Other interesting aspects of this study are the following:

- We used a 40-year life of the road, since well-designed mountain roads with low traffic and good maintenance will have a long life.
- We have provided adequate maintenance costs including a four year cycle of periodic maintenance in the cost stream; and the Bhutanese government has a good track record in road maintenance.
- We used alternative transport costs (without the project) at the present cost of mule transport, which is about $3 per ton-km, which reflects competitive market prices which are slightly above Government-proposed tariff.;
- The motorized traffic (after project) is assumed at about US$0.4 per ton-km, which is higher than elsewhere, but reflects the conditions in Bhutan.
- Estimation of transport benefits was limited to non-farm traffic, since benefits for farm traffic was included as part of a separate analysis of net incremental income from agriculture, arising from the transport and other market incentives provided by improved road access.

The result of the analysis shows a 15% economic rate of return for a 37 km road, even though this road has high construction cost of about $100,000 per km, and the direct beneficiaries number only about 8000. This high rate of return in spite of high investment costs is due to the special efforts made to bring out most measurable project benefits into the analysis, so as to show the true value of improving rural access in a productive but remote area like Bhutan. Sensitivity tests show that if we assume only 20 years life as is normally done in project analysis (for no good reason), the rate of return would decline to 10.5%. If we exclude education and health benefits (also for no good reason) , the rate of return will further reduce to about 8%. This shows the importance of trying to quantify social benefits from rural roads, which used to be ignored because of difficulties in quantification. The World Bank would continue to improve on methods for quantifying these social benefits from rural roads through more research studies.

4. *Lessons learned from experience in making rural road interventions more effective and sustainable*

The World Bank experience of working on rural road projects and policy reforms in South Asia, among others, have taught the following lessons:

4.1 Need for careful economic analysis, taking into account the actual conditions and features of the project area and present types and costs of transport, and including some form of quantification of social benefits; the latter can be done through norms

established based on a sample study of at least one project road in each comparable project area with similar geographic and other features; these norms can then be applied to other roads in the same region with similar features and mobility constraints. (The use of HDM model , even its revised version, may not be relevant for rural roads, in view of the dominance of NMT on most rural roads; this is discussed further below).

4.2 Community participation and involvement

Bringing the user communities actively into all stages of project selection , design options, project implementation and maintenance and also involving them in partial funding or provision of other inputs , is important for building local ownership and commitment in making the investment projects more successful and in making maintenance more sustainable. We have many examples of this. As an illustration, we can state the case of the Second Rural Roads and Markets Improvement project in Bangladesh (ongoing), supported by IDA and SDC, which is considered a flag-ship operation in stakeholder participation; community consultation, improved prioritization and design of roads, and a partly-community-funded rural structures component has opened up new vistas in promoting local initiatives in rural infrastructure improvements and has become a great success. We also found that it is important to provide good training in participatory processes to the project agency staff, in addition to getting their full commitment on participatory processes.

4.2 Focus on non-motorized transport (NMT), often the most appropriate transport for many rural roads

We have found that both roads and the vehicles which would ply on them should be given adequate attention, so that ultimately mobility and transport services would improve.

We have learned that while motorized transport will be an important user of rural roads, the main focus has to shift to non-motorized transport (NMT), which is often the predominant user of rural roads in most of South Asia. The needs of the rural farmer and trader is predominantly for moving small parcel loads, such as a few bags of fertilizers or produce at a time on short distances, and NMT is flexible and economical to meet this need, and also continues to be in abundant supply in rural Asia.

We have found that such acceptance of NMT as a main user of rural roads changes many aspects of rural road planning, economic analysis and design features. For example: the highway design model (HDM), even new versions, become irrelevant for deciding on thresholds of rural road improvements, since the cost parameters (for example the cost of human energy used in plying NMT), is inconsistent with the motor fuel prices and other features built into the HDM. We have, therefore, used in Bangladesh and other countries in South Asia, a different approach to economic analysis of rural roads, based on the resource costs involved in operating NMT on unimproved and improved roads. In the case of Bangladesh, the rates charged by rickshaw-van operators are higher by about 50-60% on rough unimproved roads without drainage structures, compared to rates charged on improved roads; given the competitive nature of the rickshaw market, this differential is taken to reflect the food costs and other costs needed to ply the vehicles on the unimproved roads; it has also been found that rickshaw van traffic increases significantly on improved roads, along with the emergence/increase of motorized traffic).

Similarly, we found road design features have to be suitably adjusted for NMT; we found from user surveys in Bangladesh that NMT users (particularly rickshaw-van users) complained that they often fall into road-side ditches, whenever they give way to the occasional bus or truck passing the road; we therefore found it appropriate to provide for hard shoulders for the high-NMT traffic rural roads, in the interest of safety and efficiency.

We also found it relevant to study /encourage improvements in the traditional design features of NMT, in order to make them more efficient (more traction with same effort) and more safe. In view of the large scale benefits to masses of people using these vehicles, the World bank has funded, jointly with the Swiss Development Cooperation (SDC), a project component to help improve the design of existing rickshaw vans in Bangladesh. This work is being done through local NGOs who closely work with local users, designers and producers of these vehicles; this work is showing good success already.

4.3 Rural transport improvements help alleviate poverty

We have found that improved rural access helps reduce rural poverty in many ways; through health centers and school facilities for the rural poor; and by giving careful consideration and efforts, we can design projects with features to maximize the impact on poverty reduction. Emphasis on continued and more efficient use of NMT as part of rural

roads projects is very consistent with efforts to help alleviate rural poverty. The poor can easily afford NMT and many poor are employed as NMT operators, improved rural access enhances in many ways opportunities for the poor to get more employment and income, and better education and health facilities. Where appropriate, project designs can be adjusted to include components for planting trees alongside the rural roads(as done in Bangladesh) and for employing regular road maintenance teams, enhancing environmental quality and sustainability, while also giving poor people opportunities for work. In Bangladesh, such programs have helped destitute women groups to find income and productive employment. Measures to promote use of labor-based technology, with appropriate small equipment, will also provide productive employment to the rural poor, in addition to leaving a sustainable and affordable skill in the rural areas for future road maintenance.

4.4 Emphasis on road maintenance to ensure sustainability

A lesson learned by the countries and financing partners in South Asia, as in other countries, is the paramount need for ensuring that adequate maintenance funding would be available and maintenance would be done efficiently and regularly. The projects supported by the World Bank make serious efforts in these areas. In Bangladesh, for example, Government has guaranteed the allocation of adequate funds for rural roads maintenance in the whole country, as part of the Credit agreement for the ongoing project; the annual amounts have been mutually agreed, and the Government of Bangladesh has honored this commitment. The LGED, the project agency which is also in charge of most rural roads in the country, has set up a maintenance engineering cadre to add respectability and better responsibility for maintenance functions, and many efforts are under way to further improve the efficiency of selecting and implementing road maintenance works.

Another lesson is that maintenance will be done better if local governments (such as Panchayats in India) are given more responsibilities and funding sources for the purpose. Recent examples from many Indian States, such as Kerala in South India where such autonomy has been given to local governments, testify to great success from such initiatives.

4.5 Emphasis on building up local small contractor capacity, and using labor-based technology

The South Asian experience shows that both the above strategies are important ingredients in making a successful and sustainable maintenance policy, and in encouraging local skills and enterprise. There are numerous examples of success in this regard. We also found that a consistent national policy for encouraging small contractors with training and assistance for acquiring small equipment involving the private sector as far as possible would be important for success in these areas.

5. Conclusion

This paper presented evidence from a number of research studies in South Asia on the strong linkage between road development and socio-economic development in rural areas. The findings of the studies demonstrate that "rural accessibility" is a major contributor to agricultural productivity and output, to higher school enrolment level of boys and girls, and to more employment and income earned by the poor and women.

Studies show that the first major socio-economic impacts come from the provision of basic access (*kutcha* roads); further improvements in the quality of access (such as all weather paved roads) bring significant incremental benefits.

The paper also presents ongoing studies in India, Bangladesh and Bhutan, with improved methodology to further study the impact of rural roads. The ongoing studies use improved statistical techniques and analyses, and would give greater focus on poverty linkages, and quantification of social benefits associated with rural roads/ rural transport services.

A recent study in Bhutan shows that social benefits of education and health provided through improved road access can be quantified. If all benefits are fully accounted for, justification for rural road investments becomes obvious and stronger, even in remote areas.

The last section of the paper looks at the lessons learned and successful experiences in South Asia. These experiences indicate that local level community participation at the stage of planning, funding, implementation and maintenance is crucial to make rural road interventions more efficient and sustainable. It is also important that there is assurance of funding for the maintenance of the project. Experience further points to the need to incorporate the role of NMTs in rural transport projects. Lastly, and very importantly, the experience also suggests that rural transport interventions can play an important role to alleviate poverty in rural areas, and that projects can be designed to enhance their poverty impact.

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Workshop Conclusions

Ian Johnston,
Chairman, REAAA Technical Committee

A feature of all special sessions at the XXIst World Roads Congress was the preparation of a brief statement of conclusions. This not only served as a summary statement for use in the closing session at the Congress but as a set of "recommendations" to the organisers, in this case both REAAA and PIARC.

What follows is my attempt to capture the key points and suggestions for action from the papers but, more importantly, from the discussion (as readers are able to draw their own conclusions directly from the papers). I am indebted to Dr Theo Michels, who acted as Technical Secretary for the workshop, and drafted the summary statement for use in the closing session. I have drawn on this summary in preparing what follows as well as on a videotape of the discussion. I accept full responsibility for the following statements. They are my opinion and should not be interpreted as representing the views of any organisation or association.

Key Conclusions

1. Secondary road systems comprise a vital but often overlooked and underfunded part of the rural transport system in developing countries.
2. This occurs because existing investment decision tools rely largely on conventional economic benefit criteria, particularly the movement of goods to market, but this is not where the major benefits from rural secondary roads accrue.
3. It also occurs because the theory and practice of road engineering has developed largely within the environment of major roads (the professional culture is a "big roads" culture).
4. Research has shown that the key benefits of rural secondary roads accrue in improved schooling, improved health, agricultural productivity and poverty alleviation; that is from accessibility for local communities to services and to ideas rather than from efficiencies in getting goods to market.
5. It follows from this that creating and maintaining access (across all seasons) is the critical objective. Thus all weather maintenance is more important than the conventional focus on priorities related to design standards driven in turn, by traffic volume considerations, especially where those volumes do not adequately take into account non-motorised traffic.

Recommendations

1. Creating a separate institution to plan for, design, construct and maintain secondary rural roads, possibly under that arm of government responsible for poverty alleviation and general social development. This would align the institutional goals more closely with the expected benefits rather than the present system where all roads are assessed using (for the most part) criteria biased towards primary roads. (There are, of course, many ways of achieving the same objective and it may be that improvements in the effectiveness of local government institutions is the key need).

2. Developing new investment decision tools which include a far wider range of criteria in order to ensure that all the potential benefits of investment options are fully considered. There is no doubt that secondary rural roads cannot compete successfully with primary roads under current investment decision criteria.This would require a substantial investment in research and this should be considered by the international funding agencies as well as by organisations such as REAAA and PIARC.

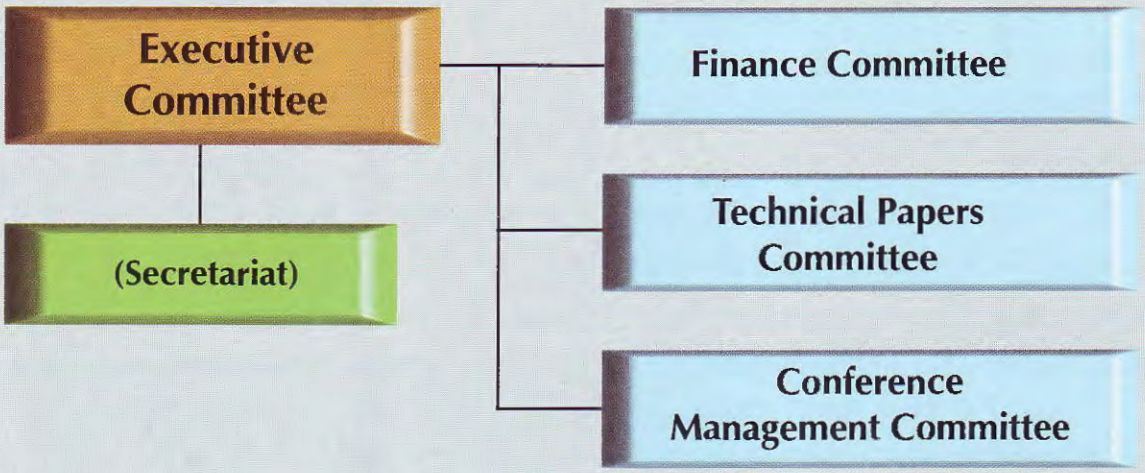
3. Shifting the emphasis in secondary rural road management to the establishment of all year trafficability, that is on maintaining accessibility to local communities for it is clearly accessibility that underpins all the critical benefits. It may well be that special design criteria and maintenance intervention criteria require development for such roads as a separately identified category.

Invitation to the 10th REAAA Conference

4-9 September 2000, Tokyo

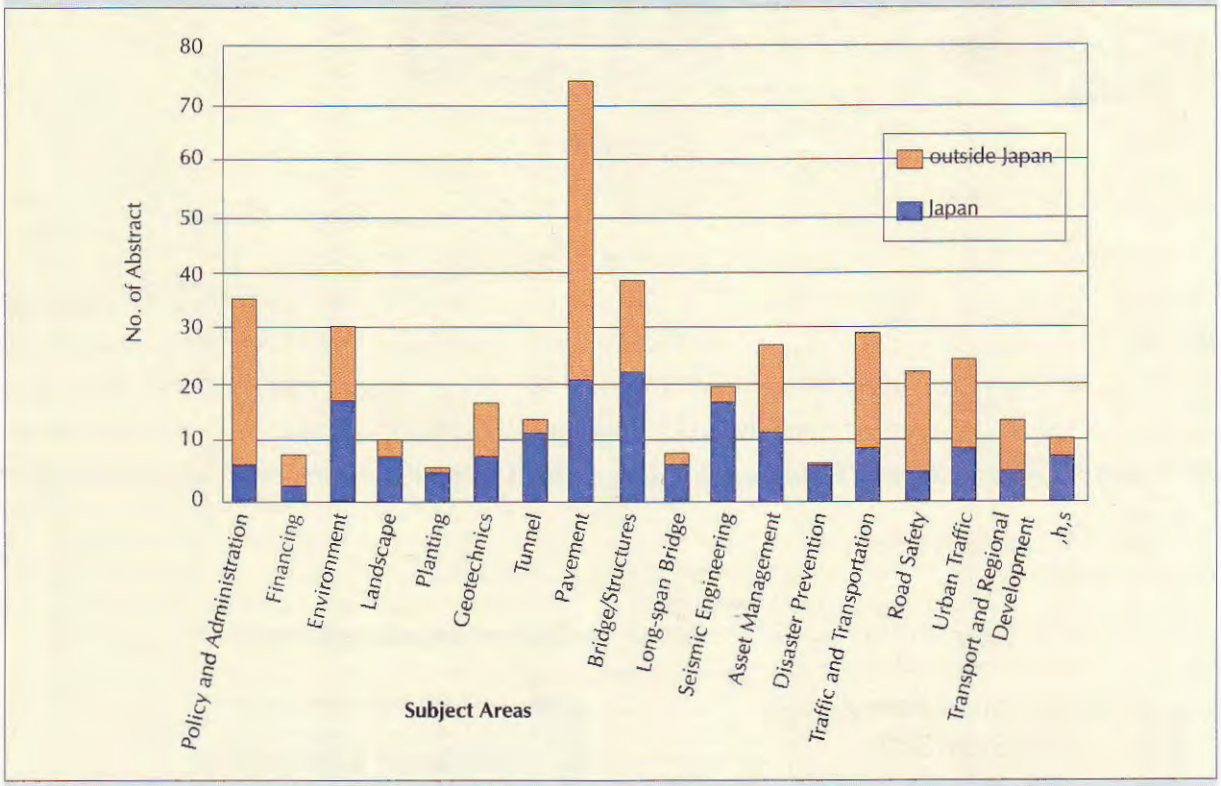
Preparations for the 10th Conference in Tokyo, to be held for the first time in Japan in REAAA more than a quarter of century history, well underway. Three operating committees exist under the Executive Committee chaired by Mr. Hiroshi HAGIWARA. They are Technical Papers Committee headed by Dr. Yukihiro SUMIYOSHI, Finance Committee under Mr. Akira MOTOMURA and Conference Management Committee led by Mr. Tadashi KONDO. (Figure~1)

Figure 1: Structure of 10th REAAA Conference Organizing Committee



So far, 370 abstracts from 30 countries have been submitted as shown in Figure~2. This is well above original planning forecasts. Given this number of papers, the Secretariat, along with the Conference Management Committee, is planning a variety of formats in the technical sessions for presentations and/or discussions. Some of the sessions may take the form of a workshop or a round table discussion depending on the number of papers and participating countries in given subject areas. At the same time, the Secretariat intends to classify the papers in accordance with the sub-themes of the conference and arrange them in a program such that the participants can attend as many as possible. The general concept will be included in the 2nd Circular (end of March) and the program will be finalised late July or early August in Pre-Program, both of which will be distributed to all concerned.

Figure 2: The Number of Abstracts in Subject Areas



The Conference Secretariat shall be happy to provide the Second Circular on request by mail, e-mail or fax.

1. Date : September 4-9, 2000 (8 and 9 are for Technical Tours)
2. Venue : Keio Plaza Hotel (Shinjuku, Tokyo)
3. Main Theme : Road Development for 21st Century
4. Sub-Theme: a. Road Environment
   b. Road Safety and Security for the Daily Lives
   c. Road Technology and Efficiency of Road Traffic
   d. Road Financing, and Public and Private Partner ship
   e. Road Development and Policy
5. Host : Road Engineering Association of Asia and Australasia (REAAA)

6. Co-host : Japan Road Association, Express Highway Research Foundation of Japan, Express Technology Center, Japan Highway Landscape Association, Japan Civil Engineering Contractor's Association Inc., Japan Road Contractors Association, Japan Association of Steel Bridge Construction, Japan Prestressed Concrete Contractors Association, Japan Civil Engineering Association,

7. Participants: About 1000 Road Engineers from World Wide are expected to participate.

8. Language : English

9. Technical Session:

More than 350 technical papers submitted from 30 countries (23 countries in Asia and Australasia, 1 from Africa, 6 from Europe, and 1 from the US) are classified into five sub-themes and detailed topics accordingly, several technical sessions are

to be held for presentation and discussions among participants. In parallel to these technical sessions, a special session on "Toll Road System" is also arranged, which is presented by both the World Bank and Ministry of Construction-Japan.

10. Keynote Address:

Keynote addresses are scheduled everyday by prominent persons.

11. Technical Tour:

Technical tours are carried out during and after the conference to introduce the status of road construction and maintenance in Japan. Several tours such as ITS facilities and the Tokyo Wan Aqua-line (Trans Tokyo Bay Highway), road status in Tokyo Metropolitan, and Highway Oasis, a new highway facilities, to name a few.

12. Registration:

Please refer to the Second Circular of Homepage for detailed information of conference registration.

(in Japanese Yen)

	Early Registration by 30 June 2000	**Standard Registration after 1 July 2000**
Non-members of REAAA	60,000 yen	66,000 yen
Members of REAAA	54,000 yen	60,000 yen

For any inquiries, please contact:

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